

## CLINICAL UPDATE

# Decrease of Cardiovascular Emergencies During the COVID-19 Pandemic

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## ABSTRACT

The new coronavirus (COVID-19) outbreak was declared a pandemic by the World Health Organization on March 11, 2020. Since then, important changes have been observed in the medical world, both in terms of patient management and patient presentations to the hospital. A dramatic decrease in the number of cardiovascular emergencies presenting to the emergency rooms has been reported in every country affected by the COVID-19 pandemic. This resulted mainly from the fear of patients to present at the hospital due to the risk of infection with the new coronavirus. Moreover, a significant increase in the time spent for investigations and specialized treatment has been reported for patients suffering from acute cardiovascular diseases. This adds to the longer times reported from symptom onset to presentation, and also to the longer period spent for triage in the emergency room. The aim of this paper is to highlight the dramatic reduction in the number of cardiovascular emergencies during the COVID-19 period and its possible explanations.

**Keywords:** COVID-19, infection, cardiovascular emergencies, complications

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## INTRODUCTION

The new coronavirus causing the COVID-19 outbreak was first reported in Hubei, a province of China, on December 8, 2019. Subsequently, on March 11, 2020, the World Health Organization classified this phenomenon as a pandemic.<sup>1</sup> Since then, over 3.67 million people tested positive, and more than 250,000 died from this infection by May 7, 2020. Moreover, COVID-19 has a similar infection rate in both genders, but is associated with a higher mortality rate in males.<sup>2</sup>

From a pathophysiological point of view, there are three phases of progression of COVID-19 infection: the first phase is the infection itself, followed by a second

phase of respiratory distress and the last phase characterized by a systemic hyperinflammatory state.<sup>3</sup> The first phase of infection includes infiltration and proliferation of the virus in the epithelium and lung parenchyma, which is associated with moderate symptoms. The first response of the immune system includes activation of monocytes and macrophages. Respiratory distress occurs in the second phase when the progression of systemic inflammation is associated with vasodilation, increased endothelial permeability, and leukocyte extravasation. All these lead to pulmonary damage, fluid extravasation, and hypoxemia, which augment the cardiovascular stress. Finally, the third phase culminates with systemic inflammation up to eliciting a cytokine storm.<sup>4</sup>

Associated comorbidities in patients infected with COVID-19 were described in a study that assessed 72,314 patients, of whom 44,672 (61.8%) were confirmed with the new coronavirus, 16,186 (22.4%) were suspected cases, and 889 (1.2%) were asymptomatic. From all the confirmed patients, 12.8% had hypertension, 5.3% diabetes, and 4.2% cardiovascular diseases.<sup>5</sup> A similar study that included 5,700 patients belonging to New York City, Long Island, and Westchester County found similar results, with hypertension (56.6%), obesity (41.7%), diabetes (33.8%), coronary artery disease (11.1%), and congestive heart failure (6.9%) being the most common comorbidities in patients with COVID-19 infection.<sup>6</sup> It seems that people who develop a more severe coronavirus infection may be more vulnerable because of comorbid diseases. However, it is not yet exactly known whether diabetes, hypertension, or cardiovascular diseases increase the risk of infection, or are just incidental associations in older patients.<sup>2</sup> Reports from the United Kingdom and the United States of America (USA) have also shown that ethnicity could play an important role in susceptibility and outcomes of COVID-19 infection.<sup>7</sup> Also, morbidity is higher among elderly patients, as shown in studies that investigated this issue.<sup>8,9</sup>

Patients with COVID-19 infection appear to develop cardiac manifestations similar to other viral infections that cause respiratory distress, including SARS (Severe Acute Respiratory Syndrome) and MERS (Middle East Respiratory Syndrome) viruses. The cardiovascular effects of viral infections translate into arterial hypotension, myocarditis, arrhythmias, and sudden cardiac death, as well as subclinical left ventricular diastolic impairment, troponin elevation, and heart failure. Autopsy studies have revealed that deceased patients with confirmed SARS-CoV-2 infection presented inflammatory infiltrates in the myocardial samples. Also, COVID-19 infections were linked with increased levels of cardiac biomarkers that illustrate myocardial injury. This could be, most likely, caused by infection-induced myocarditis or ischemia.<sup>10,11</sup> In a study of 416 patients, 57 of whom died, heart injury was a common finding (19.7%). In addition, of the deceased patients, 10.6% had coronary artery disease, 4.1% had heart failure, and 5.3% suffered from cerebrovascular disease.<sup>12</sup>

## THE IMPACT OF THE COVID-19 PANDEMIC ON CARDIOVASCULAR EMERGENCIES

A significant decrease of emergency presentations for cardiovascular symptoms has been reported worldwide.<sup>2</sup> One of the reasons for this could be related to the concern of the population, according to which the in-hospital risk of

contagion is significantly increased. In an observational study from Austria, Metzler *et al.* pointed out that between weeks 10 and 13, there was a major unexpected decline in the number of hospital admissions for acute coronary syndromes (ACS) (39.4%) across the country. More specifically, the number of ST-elevation myocardial infarction (STEMI) cases severely decreased from 94 cases per week to 70 cases, over a period of less than a month. This decrease was similar for non-ST elevation myocardial infarction (NSTEMI) (decrease from 132 to 67 admissions during the three weeks of study).<sup>13</sup>

A study conducted in Hartford, Connecticut, USA, aimed to compare the number of STEMI and non-ST elevation acute coronary syndrome (NSTEMI-ACS) presentations by month (December 2019 – April 2020) with the monthly average of the same period from the previous 4 years (2015–2019). Their results showed an increase in STEMI cases in February (with 38%), followed by reductions by 16% and 21% in March and April, respectively. Also, for NSTEMI-ACS cases there was a reduction by 21%, 37%, and 80% in February, March, and April, respectively. In terms of deaths, three cases were reported, one of which was caused by late hospitalization due to fear of COVID-19 infection.<sup>14</sup>

Moreover, the results of the same study showed a delay in the time from onset of symptoms to the first medical contact, which increased with  $75 \pm 196$  hours.<sup>14</sup> Similarly, Rodriguez-Leor *et al.* reported a case series of patients with delayed presentation for STEMI showing typical clinical symptoms, who had not sought medical treatment due to fear of COVID-19 contagion during hospital admission.<sup>15</sup> Tam *et al.* conducted a study that analyzed the time required for primary percutaneous coronary intervention (pPCI) in patients with STEMI from January 25, 2020 to February 10, 2020.<sup>16</sup> Their results revealed significantly longer median times during all phases of the STEMI network (from symptom onset to first medical contact, to transfer to a cath lab, as well as door-to-balloon times), compared to the same procedures performed a year earlier. These delays were caused by late presentation of patients, but also by the longer time required to perform the necessary diagnostic investigations, the use of personal protective equipment, and longer transportation times. In addition, the medical staff in the catheterization laboratory requires more time to perform the same procedures while wearing a full protective gear.<sup>16</sup>

In a study conducted in Spain, with data collected from 73 centers, there was a significant reduction in the number of diagnostic procedures (–56%), therapeutic coronary interventional procedures (–48%), structural therapeutic procedures (–81%), and procedures performed for STEMI

patients (–40%) from March 16 through March 22 (2020), compared to the period between February 24 to March 1 (the month prior to the beginning of COVID-19 in Spain).<sup>17</sup> A consortium of trainees in interventional cardiology across the USA reported that invasive procedures had decreased drastically from March to April 2020, from 4,671 to 2,548 (down by 47%). At the same time, the lowest average number of interventions was reported between April 1–April 15, 2020 (–80%).<sup>18</sup> Similarly, another American group found the same significant reduction in interventional cardiology procedures during the pandemic (down by 38%), compared to the period before the COVID-19 outbreak.<sup>19</sup>

A study performed in North Carolina, which looked into the number of cardiac catheterization cases indicated for STEMI between January–March (from 2018 to 2020), showed a 9.5% decrease in cases between February and March, 2020 compared to the monthly average of cases in the same period in 2018 and 2019.<sup>20</sup> A retrospective study conducted in northern Italy compared hospital admissions for ACS between February 20 and March 31, 2020 with two other control periods: January 1 to February 19, 2020, and February 20 to March 31, 2019. They noted a decrease in the mean admission rate for ACS during the study period (13.3 admissions per day compared to 18.0 in the first control period and 18.9 in the second control period). Also, taken individually, there was a significant decrease in STEMI presentations (6.1 cases vs. 7.8 vs. 8.0 across the three timelines), as well as in NSTEMI cases (4.2 vs. 7.1 vs. 7.5 across the three timelines).<sup>21</sup> Notably, there was no difference between the three time periods regarding the number of presentations in emergency settings for patients with unstable angina.<sup>21</sup>

Several unpublished data from Romania indicate a dramatic decrease in therapeutic coronary interventional procedures for STEMI during the COVID-19 outbreak compared to the previous period (–75%) and also a reduction in the number of STEMI patients transferred from primary and secondary hospitals (–70%). These data indicate that we are facing an unprecedented period, in which the cardiology community must sustain a constant effort, together with the whole medical community, to not only treat the COVID-19 infected patients, but also prevent the setbacks in the implementation of current therapeutic guidelines for cardiovascular disease. This may be achieved by a close collaboration across medical specialties, but also with the media for patient education.<sup>22,23</sup>

## WHAT THE FUTURE HOLDS

The medical world does not know exactly what the future brings, but what is clear is that during this period, pa-

tients avoid going to the hospital or extend the waiting period until they present to the emergency departments. This will probably lead to increased mortality and morbidity from cardiovascular emergencies, and to a higher number of cases with out-of-hospital cardiac arrest. It is estimated that these types of cases will increase by up to 75%.<sup>24</sup> Also, an extension of revascularization times in STEMI will increase complication rates, with further associated risk of death. On a long term, this delayed access to reperfusion treatment may lead to a more severe ventricular remodeling, chronic heart failure, or ventricular arrhythmias.<sup>25</sup> At the same time, in the next period, the measures taken to prevent COVID-19 infection in hospitals are of utmost importance, because cardiovascular patients are at high risk of developing severe complications. Moreover, it is inadmissible for the medical staff to be exposed to infection, as it happened in Spain, the USA, or Italy, where almost 20% of the responding healthcare workers were infected or died due to lack of protective equipment. All these issues should be resolved in a near future in order to minimize the risk of contacting the disease.<sup>26,27</sup>

## CONCLUSION

The SARS-CoV-2 pandemic has a major impact on cardiovascular diseases as a whole, including presentation, complications, and management of patients with cardiovascular emergencies. This puts the global medical community at a great task and raises awareness regarding the prompt hospital presentation and management of patients with signs and symptoms indicative for a major cardiovascular emergency, in which time is crucial for survival. The fear of nosocomial infections, the longer time required for triage and the good, but extreme measures taken by governments to minimize the spread of the virus, challenge the cardiology community. We do not know what tomorrow brings, but through work and dedication we hope for a better understanding and management of this disease.

## CONFLICT OF INTEREST

Nothing to declare.

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