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The effect of the COVID-19 pandemic on acute coronary syndrome hospitalizations and out-of-hospital cardiac arrest in Greece

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ABSTRACT

Objectives: After coronavirus disease 2019 (COVID-19) outbreak, striking decreases in the number of hospital admissions for acute coronary syndromes (ACSs) and rises in rates of out-of-hospital cardiac arrest (OHCA) have been noted.

Study design: This is an analysis of prospectively collected data from a cardiology department in a single, large volume hospital of the National Health System of the Metropolitan area of Athens.

Methods: We investigated the numbers of OHCA and hospital admissions for ACS during a 1-year period and made comparisons between the pre-COVID-19 and the COVID-19 outbreak periods.

Results: One hundred and eighty five patients were admitted during the total period of observation with the diagnosis of ACS. The mean monthly number of admissions for ACS for the pre-COVID-19 era was significantly higher than that for the post-COVID-19 era (20.1 ± 7.8 vs 8.8 ± 6.5 admissions, P = 0.024). The cases of OHCA which were transferred to our emergency room department by emergency medical services during the same period were nominally lower in the prepandemic compared with the post-pandemic era (1.9 ± 1.7 vs 4.0 ± 4.6, P = 0.28).

Conclusions: The present study provides hints on the potential unintended consequences of the pandemic in countries characterized by fewer COVID-19 cases and fatalities but prompt measures of social contact restrictions and lockdown.

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To face the coronavirus disease 2019 (COVID-19) pandemic,1 strict social containment measures have been implemented worldwide, and healthcare systems have been reorganized to cope with the expected surge in the numbers of critically ill patients.2 However, Greek authorities adopted strict and timely social distancing policies to contain COVID-19 spread.3 These policies were proven highly efficient as Greece reported one of the lowest incidence and fatality rates worldwide during the first pandemic wave.4 After COVID-19 outbreak, striking decreases in the number of hospital admissions for acute coronary syndromes (ACSs) have been noted.5,6 Similarly, early studies from regions severely affected by the pandemic have supported that the rates of out-of-hospital cardiac arrest (OHCA) have significantly risen during this period.7 Furthermore, mechanical complications of ACS, which have been rendered infrequent in the era of timely coronary reperfusion, have resurfaced during the pandemic.8 Lockdown measures which hinder access to healthcare services and/or fear of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) contraction, which deters patients from seeking health care, could be advocated as potential explanations for aforementioned trends. Nonetheless, data from countries, which have been least affected by the pandemic, such as Greece, are for the time limited. The aim of the present analysis was to investigate the numbers of (a) hospital admissions for ACS and (b) OHCA during a 1-year period (July 1, 2019–June 30, 2020) and make comparisons between the pre-COVID-19 and the COVID-19 outbreak periods.

This is an analysis of prospectively collected data from a cardiology department in a single, large volume hospital of the National Health System of the Metropolitan area of Athens (Laiko General Hospital, Athens). Based on an ad hoc design form, we collected demographic data, data pertaining to patient history, clinical presentation, laboratory profile, treatment, and in-hospital outcomes.
of patients presenting with ACS. We divided the study period into two subperiods: 1st July 2019 up to 31st January 2020 (preponder- 
demic period) and 1st February up to 30th June 2020 (COVID-19 
outbreak period). To assess for simultaneous trends in OHCA, we 
analyzed all cases of OHCA which were transferred to our emer-
gency department during the same period by emergency medical 
services (EMSS). We collected demographic data (such as age and 
gender) and data pertaining to patient history among the latter 
patients. The study was approved by the ethics committee of our 
institution and was carried out in accordance with the Declaration 
of Helsinki.

One hundred and eighty five patients were admitted during the 
total period of observation with the diagnosis of ACS. The mean 
monthly number of admissions for ACS for the pre-COVID-19 era 
was significantly higher than that for the post-COVID-19 era 
(20.1 ± 7.8 vs 8.8 ± 6.5 admissions, P = 0.024, Supplementary 
Fig. 1A). The number of hospitalizations for ACS was remarkably 
lower for the months that aggressive lockdown measures (quar-
tantine) were enforced (March and April 2020) when compared 
with the other months of the pandemic (5.5 ± 2.1 vs 11.8 ± 6.8, 
P = 0.16).

The baseline characteristics of the patients hospitalized for ACS 
during the study period and the characteristics of their hospitali-
sations stratified by the two subperiods are depicted in Table 1. 
There were not significant differences in terms of age, history, and 
other available parameters indicating severity (type of ACS, high-
sensitivity troponin T levels, left ventricular ejection fraction). Pa-
patients presenting before the COVID-19 era had significantly lower 
levels of total cholesterol (168 ± 43 vs 185 ± 48 mg/dl, P = 0.036) 
and a trend toward lower levels of low-density lipoprotein (LDL) 
cholesterol (99 ± 37 vs 111 ± 37 pg/ml, P = 0.067), compared with 
patients presenting during the pandemic. These differences are 
most probably attributed to the higher rates of statin receipt among 
patients of the pre-COVID-19 era (45.4% vs 22.7%, P = 0.007). 
Importantly, patient outcome rates in terms of invasive therapy and 
death did not differ between the two subperiods (Table 1). Inter-
estingly though, the patients presenting before the COVID-19 era 
had significantly more diseased vessels compared with patients of 
the COVID-19 era (1.9 ± 1.0 vs 1.5 ± 0.8, P = 0.018), reinforcing 
the notion that, in the pandemic period, patients with more extended 
coronary artery disease may have not reached the hospital alive. 
The cases of OHCA which were transferred to our emergency room 
department by EMSS during the same period were nominally lower 
in the pre-COVID compared with the postpandemic era (1.9 ± 1.7 
vs 4.0 ± 4.6, P = 0.28, Supplementary Fig. 1B). Moreover, in the 
COVID-19 era, one patient (2.3%) developed a ventricular septal 
rupture after presenting delayed with a large anterior myocardial 
infarction. No mechanical complication had been witnessed in the 
pre-COVID-19 era.

In conclusion, the COVID-19 pandemic is associated with 
reduced numbers of ACS admissions, possibly due to the restrictive 
measures in healthcare facilities. Even so, the ACS patient profiles 
during the pandemic did not significantly differ, a fact implying that 
this trend was not guided by a true reduction in healthcare needs, 
but rather than to limited seeking of healthcare services on pa-

tients’ end.9 The simultaneous increases in OHCA corroborate, 
although do not prove, this hypothesis. Similar trends have been 
recently reported from New York City, USA, a region dramatically 
afflicted by the pandemic.10 The present study, however, is the first 
to provide hints on the potential unintended consequences of the 
pandemic in countries characterized by fewer COVID-19 cases and 
fatalities but prompt measures of social contact restrictions and 
lockdown. Future studies should address the impact of the 
pandemic on the population-level morbidity and mortality rates of

Table 1
Baseline and hospital-related characteristics of study patients.

| Variable                          | Prepandemic era (N = 141) | Pandemic era (N = 44) | P    |
|-----------------------------------|---------------------------|-----------------------|------|
| Age, years                        | 65.4 ± 12.1               | 65.8 ± 12.9           | 0.88 |
| Male gender, %                    | 83.7                      | 75.0                  | 0.19 |
| Coronary artery disease, %        | 29.1                      | 22.7                  | 0.41 |
| Dyslipidemia, %                   | 54.6                      | 45.5                  | 0.29 |
| Statin, %                         | 45.4                      | 22.7                  | 0.007|
| Hypertension, %                   | 57.4                      | 45.5                  | 0.16 |
| Smoking, %                        | 41.8                      | 34.1                  | 0.48 |
| Former                            | 12.1                      | 18.2                  |      |
| Chronic kidney disease, %         | 9.2                       | 9.1                   | 0.98 |
| Diabetes mellitus, %              | 33.3                      | 22.7                  | 0.18 |
| Serum creatinine, mg/dl           | 1.3 ± 1.4                 | 1.5 ± 1.4             | 0.54 |
| High sensitivity troponin T, pg/ml| 2,242 ± 4030              | 1,742 ± 2,966         | 0.38 |
| Total cholesterol, mg/dl          | 168 ± 43                  | 185 ± 48              | 0.036|
| LDL cholesterol, mg/dl            | 99 ± 37                   | 111 ± 37              | 0.067|
| HDL cholesterol, mg/dl            | 41 ± 14                   | 40 ± 11               | 0.80 |
| Left ventricular ejection fraction,%| 51 ± 10                   | 50 ± 10               | 0.64 |
| ACS type, %                       |                           |                       | 0.26 |
| Unstable angina                   | 15.6                      | 15.9                  |      |
| NSTEMI                             | 48.9                      | 61.4                  |      |
| STEMI                              | 35.5                      | 22.7                  |      |
| Coronary angiogram performed, %   | 92.2                      | 95.5                  | 0.46 |
| Diseased vessels, n               | 1.9 ± 1.0                 | 1.5 ± 0.8             | 0.018|
| Mechanical complication, %        | 0.0                       | 2.3                   | 0.24 |
| Outcome, %                        |                           |                       | 0.99 |
| Conservative                      | 26.2                      | 25.0                  |      |
| PCI                                | 49.6                      | 52.3                  |      |
| CABG referral                      | 21.3                      | 20.5                  |      |
| Death                              | 2.8                       | 2.3                   |      |
| Length of stay, days              | 5.9 ± 3.1                 | 5.4 ± 2.9             | 0.54 |

ACS: acute coronary syndrome; CABG: coronary artery bypass grafting; HDL: low density lipoprotein; LDL: low density lipoprotein; NSTEMI: non-ST-elevation myocardial infarction; STEMI: ST-elevation myocardial infarction; PCI: percutaneous coronary intervention.
such populations. Importantly, the rates of selected treatment modalities did not differ before and after the pandemic outbreak. Thus, contrary to what has been reported elsewhere, our data indicate that physicians’ decision-making on the course of treatment in the setting of ACS was not affected by the pandemic. Nonetheless, this warrants confirmation in larger studies.

**Author statements**

**Ethical approval**

The study was approved by the Ethics Committee of our institution and was carried out in accordance with the Declaration of Helsinki.

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**Competing interests**

On behalf of all authors, the corresponding author states that there is no conflict of interest.

**Appendix A. Supplementary data**

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2020.12.006.

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