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Impact of COVID-19 on Chronic Stable Coronary Artery Disease

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ABSTRACT

Background: Cardiac risk factors and diseases have been linked to worse outcomes related to COVID-19 infection. The goal of treatment in such patients is targeting disease stabilization or regression. However, at any time this chronic disease can change to acute coronary syndrome (ACS) due to plaque rupture with either a precipitating factor or without. **Objective:** The aim of the current study was to detect the impact of COVID-19 infection on patients with chronic coronary artery disease.

Patients and methods: A total of 102 patients with chronic coronary syndrome treated from May 2020 to September 2021 at Misr University of Science and Technology Hospitals were enrolled in our study. This cohort of patients was divided into two groups: *Group 1* (COVID-19 Group) included patients with chronic coronary syndrome and being infected by COVID-19, while *Group 2* (Control Group) included patients with chronic coronary syndrome without COVID-19 infection. Participants were followed up period of 6 months. Study outcomes were mortality and major adverse cardiovascular events (MACE) within 6 months follow up from COVID-19 diagnosis.

Results: There were statistically significant increase in number of patients with unstable angina and non-ST-elevation myocardial infarction (NSTEMI) in the COVID-19 Group versus Control Group (54.8% versus 35%, respectively). As regard left ventricular (LV) dysfunction, congestive heart failure, percutaneous coronary intervention (PCI), coronary artery bypass graft surgery (CABG), ST-elevation myocardial infarction (STEMI), and death, these were more prominent in COVID-19 (*Group 1*) than in control group with chronic stable angina but without COVID-19 (*Group 2*) but without statistically significant difference.

Conclusion: COVID-19 infection could have a direct worsening effect on coronary artery disease.

Keywords: COVID-19, Chronic coronary syndrome, Acute coronary syndrome, Major adverse cardiovascular events.

INTRODUCTION

Although COVID-19 is a primary lung disease with known lung infiltrates, it has shown other hepatic, renal and cardiac affection [(1,2)]. There is a bidirectional relationship between COVID-19 and cardiac illness. Cardiac risk factors and diseases have been linked to high suspicion for COVID-19 infection and more severe cases with worse outcomes [(2)].

Patients with chronic coronary syndrome (CCS) have been demonstrated to have a higher risk of having severe COVID-19, and to have a higher mortality rate due to the disease. CCS patients may also be at a higher risk for long-term COVID-19 problems as lung fibrosis and cardiac injury, according to some studies [(3)].

On the other side, COVID-19 infection induced cardiac diseases like myocarditis, thromboembolism, and arrhythmias. Some clinical studies have reported interaction between some cardiac diseases and commonly used medications for COVID-19 [(1,2)].

Patients diagnosed with chronic stable angina are usually chronic long-standing patients with angina that is being controlled by lifestyle modifications, medical treatment with or without coronary intervention. The goal of treatment in such patients is targeting disease stabilization or regression. However, at any time this chronic disease can change to acute coronary syndrome (ACS) due to plaque rupture with either a precipitating factor or without [(3)].

The aim of the current study was to detect the impact of COVID-19 infection on patients with chronic coronary artery disease.

PATIENTS AND METHODS

A total of 102 patients with chronic coronary syndrome treated from May 2020 to September 2021 at Misr University of Science and Technology Hospitals were enrolled in our study. This cohort of patients was divided into two groups: *Group 1* (COVID-19 Group) included patients with chronic coronary syndrome and being infected by COVID-19, while *Group 2* (Control Group) included patients with chronic coronary syndrome without COVID-19 infection.

Inclusion criteria: All patients with previous confirmed stable coronary artery disease, and mild and moderate cases of COVID-19 infection.

Exclusion criteria: Patients <18 years old and above 80 years old, severe cases of COVID-19 that need ventilation, and patients without previous history of coronary artery disease.

Follow up for 6 months duration:

Follow up for 6 months by thorough history taking, clinical examination, ECG, and echocardiography. Special attention was given for any deterioration of anginal symptoms, ECG, or echocardiography.

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Study outcomes: Mortality and major adverse cardiovascular events (MACE) within 6 months follow up from COVID-19 diagnosis.

Ethical Approval:

This study was ethically approved by the Institutional Review Board of the Faculty of Medicine, Misr University for Science and Technology University. Written informed consent was obtained from all participants. This study was executed according to the code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans.

Statistical Analysis

The collected data were introduced and statistically analyzed by utilizing the Statistical Package for Social Sciences (SPSS) version 25 for windows. Qualitative data were defined as numbers and percentages. Chi-Square test and Fisher's exact test were used for comparison between categorical variables as appropriate.

Quantitative data were tested for normality by Kolmogorov-Smirnov test. Normal distribution of variables was described as mean and standard deviation (SD), and independent sample t-test was used for comparison between groups. P value ≤0.05 was considered to be statistically significant.

RESULTS

Demographic and clinical data, including age, sex, and other risk factors (DM, hypertension, family history, dyslipidemia, and smoking) were nearly similar in both groups (**Table 1**).

Table (1): Demographic and clinical characteristics of studied groups

Variables	COVID-19 (N.42)	Control (N.60)	P-value
Age	56.55 ± 9.2	57.12 ± 8.54	1.00
Males	23 (54.8%)	39 (65%)	0.29
DM	23 (54.8%)	27 (45%)	0.33
Hypertension	22 (52.4%)	27 (45%)	0.46
Family history	14 (33.3%)	20 (33.3%)	1.00
Dyslipidemia	22 (52.4%)	26 (43.3%)	0.36
Smoking	18 (42.9%)	32 (53.3%)	0.29

*Significant, DM; diabetes mellitus

Previous myocardial infarction was the only baseline clinical diagnosis which showed significant difference between both groups, whereas other baseline clinical diagnosis showed no significant differences **(Table 2).**

Table (2): Baseline clinical diagnosis of the two studied groups.

Variables	COVID-19 (N.42)	Control (N.60)	P-value
Stable angina symptoms	12 (28.6%)	18 (30%)	0.87
Previous UA	22 (52.4%)	41 (68.3%)	0.1
Previous MI	13 (31%)	32 (53.3%)	0.02*
Previous PCI	18 (42.9%)	27 (45%)	0.83
Previous CABG	5 (11.9%)	7 (11.7%)	0.97

*Significant, UA; unstable angina, MI; myocardial infarction, PCI; percutaneous coronary intervention, CABG; coronary artery bypass graft.

Study Outcomes:

There was significant increase in unstable angina and NSTEMI patients with COVID 19 group than in control group with chronic stable angina but without COVID-19. As regard LV dysfunction, congestive heart failure, PCI, CABG, MI, and death were higher in patients with COVID-19 and chronic ischemia syndrome than ischemic patients without COVID-19 but without significant difference **(Table 3).**

Table (3): Clinical Outcomes of both groups during 6 months follow up period.

Variables	COVID-19 (N.42)	Control (N.60)	P value
UA OR NSTEMI	23 (54.8%)	21 (35%)	0.04*
LV dysfunction	9 (21.4%)	13 (21.7%)	0.97
Congestive Heart Failure	8 (19%)	8 (13.3%)	0.58
PCI	18 (42.9%)	18 (30%)	0.18
CABG	3 (7.1%)	3 (5%)	0.68
MI	6 (14.3%)	6 (10%)	0.54
Death	1 (2.4%)	1 (1.7%)	1.00

*Significant, UA; unstable angina, PCI; percutaneous coronary angiography, MI; myocardial infarction, CABG; coronary artery bypass graft.

DISCUSSION

COVID-19 infection induced some cardiac diseases like myocarditis, thromboembolism, and arrhythmias. Some clinical studies have reported interaction between some cardiac diseases and commonly used medications for COVID-19 [1,2].

Our results showed statistically significant increase in unstable angina and NSTEMI cases within COVID-19 patients **(Group 1)** than in control group **(Group 2)**

and as regard LV dysfunction, congestive heart failure, PCI, CABG, STEMI, and death, they were more in patients with chronic stable ischemic patients and COVID-19 **(Group 1)** than in control group with chronic stable angina without COVID-19 **(Group 2)** but without statistically significant difference.

As with other infectious diseases, including SARS, influenza, and COVID-19 can trigger acute coronary syndrome (ACS) [4,5,6,7,8].

Acute coronary syndrome is not uncommon to be associated with COVID-19 infection. In early studies from **China**, a small proportion of patients with COVID-19 presented with chest pain on admission to hospital, but the characteristics of the chest pain were not described [9,10]. In **New York,** a case series including patients presented by COVID-19 and ST segment elevation where most of them required percutaneous coronary intervention [8].

Additionally, 17 out of 28 patients in another Italian case series with COVID-19 and ST segment elevation myocardial infarction had a culprit lesion evident on coronary angiography and so required revascularization. Notably, in 24 of these 28 patients who did not have a positive test result for COVID-19 at the time of coronary angiography, ST segment elevation myocardial infarction was the first clinical manifestation of COVID-19 [11].

These and other investigators observed a connection between COVID-19 and acute coronary syndrome. However, the exact frequency is unknown because the initial number of cases of acute coronary syndrome was underestimated [3].

The exact mechanisms underlying COVID-19 induced ACS are still being studied. However, it is believed that the virus may cause inflammation in the coronary arteries, leading to plaque rupture and thrombus formation. This can lead to a decrease in blood flow to the heart, resulting in ACS. Direct viral infection of the cardiac muscle, a cytokine storm, and endothelial dysfunction are other possible explanations. Collagen is found in the fibrous cap of atherosclerotic plaques, and collagenases released by active macrophages break it down. Additionally, as the plaque ruptures, activated macrophages release tissue factor that causes thrombus development [7].

The comparison between reported cases of ACS before and during the COVID-19 pandemic is an important one. During the pandemic, there has been a decrease in the number of reported cases of ACS due to people avoiding medical care out of fear of contacting COVID-19 as reported in Italy, Spain, and the USA [12,13,14]. This has led to an increase in mortality rates due to delayed diagnosis and treatment. Additionally, there has been an increase in the number of people with undiagnosed ACS due to lack of access to medical care [12,13,14].

Overall, it is clear that while there has been a decrease in reported cases of ACS during the pandemic, this decrease may be offset by an increase in undiagnosed cases and those at risk due to COVID-19 related inflammation [15]. Also, according to a comprehensive global study conducted by the European Society of Cardiology, the number of people experiencing a myocardial infarction and requiring emergency hospital care dropped by more than 50 percent during the peak of the COVID-19 outbreak [16].

Our results suggest that COVID-19 had harmful effect on patients with chronic stable angina. These findings raise up a question; can we consider COVID-19 infection as one of the causes for secondary unstable angina like sepsis, anemia, etc.

Regarding this hypothesis, treatment of the cause could be the wise decision for patients with secondary angina due to COVID-19 infections. This hypothesis is supported by our results showing no statistically significant difference of mortality and other forms of morbidity away from unstable angina and NSTEMI during the intermediate term follow up period. Larger clinical trials are still needed to clearly elaborate the bidirectional relationship between COVID-19 and cardiac diseases.

LIMITATIONS: This study was only single research site, and the sample size was limited.

CONCLUSION

The effects of COVID-19 infection on patients with chronic coronary syndrome showed significant increase in incidence of unstable angina and NSTEMI and those patients need close follow up and should adhere to maximum medical anti-ischemic medication.

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