International Journal of Research in Medical Sciences
Chhabra A et al. Int J Res Med Sci. 2021 Sep;9(9):2766-2772
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20213421

Original Research Article

Coronary artery disease in post-COVID patients: a prospective study

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Received: 26 June 2021
Accepted: 28 July 2021

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ABSTRACT

Background: Corona virus disease 2019 or COVID-19 is defined as infectious illness caused by severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). The cardiovascular manifestations of COVID-19 has been a topic of immense interest amongst epidemiologists, physicians and cardiologists alike. Cytokine storm seen in patients with COVID-19 is known to cause damage to multiple organs including cardiac myocytes. Coronary arteries are also affected by direct damage as well as cytokine mediated injury to coronary endothelial cells.
Methods: This was a prospective study conducted in the department of cardiology of a tertiary care hospital. 40 patients recovered from COVID-19 and having symptoms related to coronary artery disease were included in this study on the basis of a predefined inclusion and exclusion criteria. The presenting complaints such as chest pain, breathlessness and fatigue were asked for and were documented. An informed written consent was obtained from all the participants. A standard Judkins technique was used to do coronary angiography. Severity of stenosis was assessed in all the cases. The statistical analysis was done using SSPS 21.0 software. P value less than 0.05 was taken as statistically significant.
Results: Out of 40 post COVID-19 patients presenting with symptoms attributable to coronary artery disease there were 34 (85%) males and 6 (15%) females with a M:F ratio of 1:0.17. The mean age of male and female patients was found to be 51.33±6.47 years and 44.50±6.82 respectively. 12 (30%) patients had history of hypertension, 8 (20%) had history of diabetes mellitus. 3 (7.5%) patients had history of asthma. Chest pain (95%), breathlessness (67.5%), reduced exertional capacity (55%) and diaphoresis (40%) were common presenting complaints. Slow flow due to endothelial dysfunction was the most common single finding and was seen in 8 (20%) patients. In 7 (17.5%) 51-60% stenosis with thrombosis was found whereas in 6 (15%) patients 81-90% stenosis with thrombosis was seen. In 3 (15%) patients 70-80% stenosis with thrombosis was found and in remaining 3 (7.5%) total occlusion was seen.
Conclusions: A high index of suspicion and timely intervention is necessary to diagnose and manage coronary artery disease in post covid patients.

Keywords: COVID-19, Coronary artery disease, Angiography, Stenosis

INTRODUCTION

COVID-19 is defined as infectious illness caused by SARS-CoV-2. Infection with this virus was first identified in Wuhan, China in the end of 2019.[1] Since then this infectious illness has been the cause of approximately 3 million deaths. The disease has already been declared as a global health emergency by WHO. The absence of immunity makes everyone vulnerable for infection with this virus and the fact that there is a potential of a large number of individuals getting infected simultaneously make it a global health emergency. The route of transmission is droplet infection and contact transmission (such as by coming in contact with infected objects).[2] Similar to any other viral illness majority of the cases of COVID-19 present with features such as fever,

chills, cough and body ache. In a small number of cases the disease may be severe and may cause clinical features such as breathlessness, respiratory distress or even respiratory failure requiring artificial ventilation. Neurological manifestations such as severe headache, anosmia, seizures and altered sensorium may be present in some cases.[3]

The cardiovascular manifestations of COVID-19 have been a topic of immense interest amongst epidemiologists, physicians and cardiologists alike. Cytokine storm seen in patients with COVID-19 is known to cause damage to multiple organs including cardiac myocytes.[4] In addition to cytokine mediated myocyte injury there is also evidence to show that SARS-CoV-2 directly cause injury to endothelial cells and heart (myocytes) by way of interaction with angiotensin converting enzyme-2 (ACE-2).[5] Ongoing hypoxemia which is a common finding in many patients of SARS-CoV-2 infected individuals is also one of the common causes of myocardial damage. Heart also gets affected because of side effects of medications such as corticosteroids, antiviral drugs and electrolyte imbalances seen in critically ill patients receiving intensive care. Pre-existing systemic illnesses or cardiovascular disorders may further enhance damage to cardiac cells.[6]

Coronary artery disease is one of the common causes of morbidity and mortality in patients above 50 years of age. Presence of coronary artery disease is also one of the important risk factors in patients with COVID-19 and there are various studies which showed that presence of coronary artery disease is one of the important factors for adverse outcome in patients with COVID-19.[7] Patients having coronary artery disease is found to have increased chances of mortality as compared to those without pre-existing coronary artery disease. Moreover endothelial cell damage involving coronary arteries may also result in complications such as thrombosis and consequent myocardial ischemia and even infarction.[8] Direct infection of endothelial cells and diffuse endothelial inflammation are reported by many authors in patients with COVID-19. Those with pre-existing conditions causing endothelial damage such as diabetes mellitus, hypertension, smokers and those with autoimmune vascular diseases are more prone for endothelial damages involving various vascular beds including coronary artery disease.[9]

We conducted this prospective study to analyze angiographic abnormalities in post-covid patients. The purpose of this study was to analyze presence of various angiographic abnormalities who had recovered from COVID-19.

METHODS

This was a prospective study conducted in the department of cardiology MGM medical college and hospital Aurangabad, Maharashtra. The duration of study was from October 2020 to March 2021. 40 patients recovered from COVID-19 and having symptoms related to coronary artery disease were included in this study on the basis of a predefined inclusion and exclusion criteria. Demographic details such as age, gender and duration since discharge from hospital were recorded in all cases. Complete blood count along with renal function test was done in all the cases. Known cases of coronary artery disease and those who have already undergone any kind of intervention such as angioplasty or coronary artery bypass grafting before COVID-19 were excluded from the study. The presenting complaints such as chest pain, breathlessness and fatigue were asked for and were documented. An informed written consent was obtained from all the participants.

Standard Judkins techniques was used to do coronary angiography. Severity of stenosis was assessed in all the cases. The findings of angiography were analyzed with respect to site and percentage of stenosis.

Inclusion criteria

Patients recovered from COVID-19 and presenting with complaints attributable to coronary artery disease, those who consented to be part of study and patients aged above 18 years were included in the study.

Exclusion criteria

Patients aged less than 18 years, those who refused to be part of study, patients with pre-existing coronary artery disease and patients in whom interventions such as angioplasty or coronary artery bypass grafting has been done in past were excluded from the study.

The statistical analysis was done using SSPS 21.0 software. P value less than 0.05 was taken as statistically significant.

RESULTS

A total of 40 patients were included in this study on the basis of a predefined inclusion and exclusion criteria. Our of 40 post covid patients presenting with symptoms attributable to coronary artery disease there were 34 (85%) males and 6 (15%) females with a M:F ratio of 1:0.17.

Majority of the patients were in the age group of 51-60 years (57.50%) followed by 41-50 years (37.50%). The mean age of male and female patients was found to be 51.33±6.47 years and 44.50±6.82 respectively. The difference in the mean age of male and female patients was found to be statistically significant as per student t test ($p<0.05$).

The analysis of the patients on the basis of presence of co-morbidities showed that out of 40 studied cases in 22

patients there were no co-morbidities. Out of remaining 18 patients, 12 (30%) patients had history of hypertension, 8 (20%) had history of diabetes mellitus. 3 (7.5%) patients had history of asthma.

The analysis of the patients on the basis of presenting complaints showed that majority of the patients presented with chest pain (95%). The other presenting complaints included breathlessness (67.5%), reduced exertional capacity (55%) and diaphoresis (40%).

Coronary angiography was done in all the cases. Out of 40 patients in whom coronary angiography was done, it was found to be normal in 13 (32.5%) patients. Some or the other form of angiographic abnormalities were seen in 27 (67.5%) cases. Out of 27 patients with angiographic abnormalities the most common angiographic abnormality was found to be slow flow due to endothelial dysfunction which was seen in 8 (20%) patients. In 7 (17.5%) 51-60% stenosis with thrombosis was found whereas in 6 (15%) patients 81-90% stenosis with thrombosis was seen. In 3 (15%) patients 70-80% stenosis with thrombosis was found and in remaining 3 (7.5%) total occlusion was seen.

Table 1: Gender wise age distribution.

Age groups (in years)	Males		Females	
	N	%	N	%
18-30	0	0	0	0
31-40	1	2.50	1	2.50
41-50	11	27.50	4	10.00
51-60	22	55.00	1	2.50
61-70	0	0	0	0
Total	34	85.00	6	15
Mean±SD	51.33±6.47		44.50±6.82	
P=0.0231 (significant)				

Table 2: Angiographic abnormalities in studied cases.

Abnormalities		No. of cases	Percentage
Normal		13	32.5
Slow flow due to endothelial dysfunction		8	20
Thrombosis and stenosis (%)	50-60 stenosis	7	17.5
	61 -80 stenosis	3	7.5
	81-90 stenosis	6	15
	100 occlusion	3	7.5

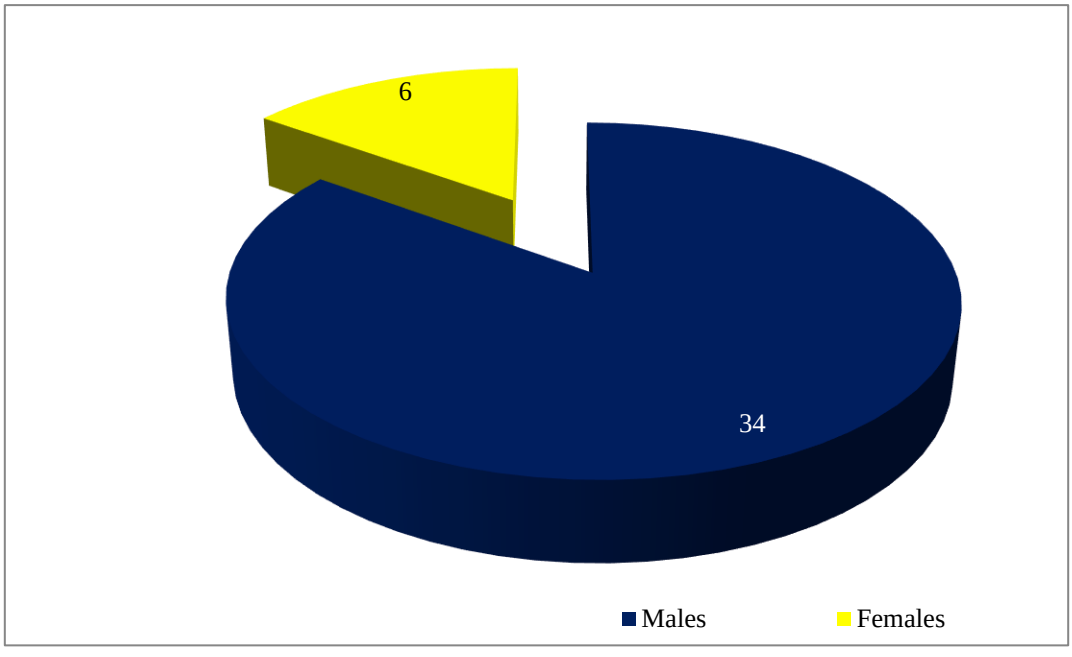

Figure 1: Gender distribution of the studied cases.

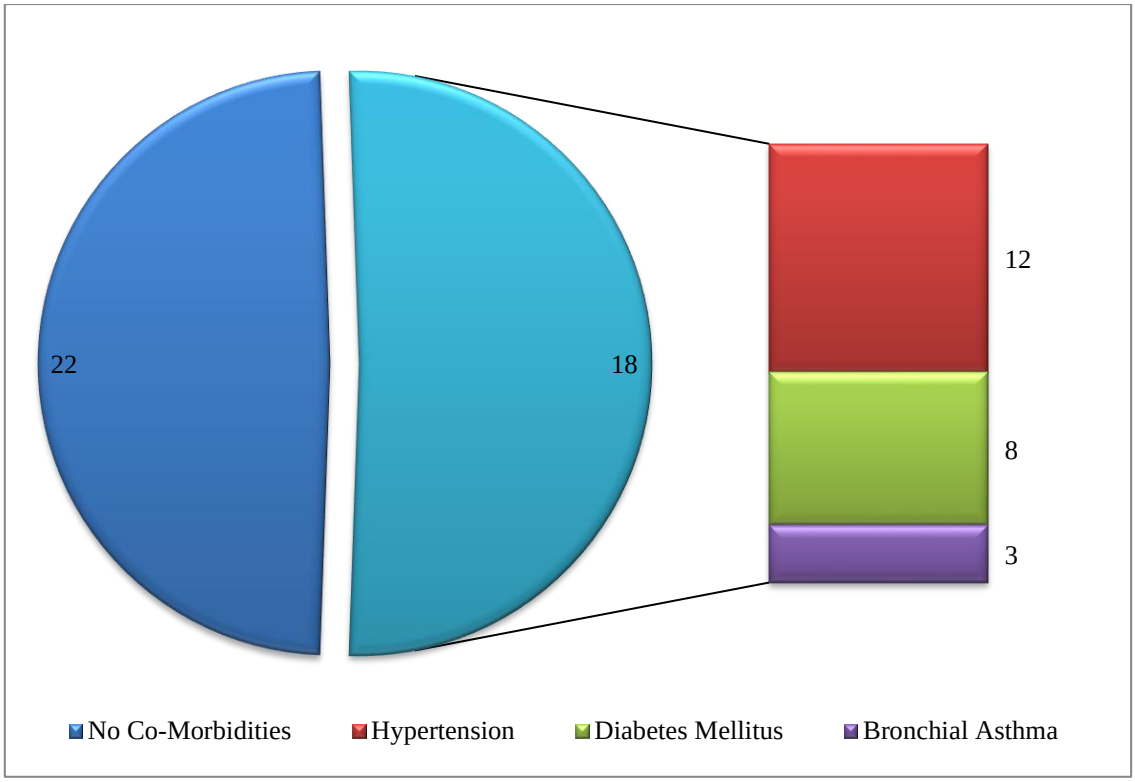

Figure 2: Co-morbidities in studied cases.

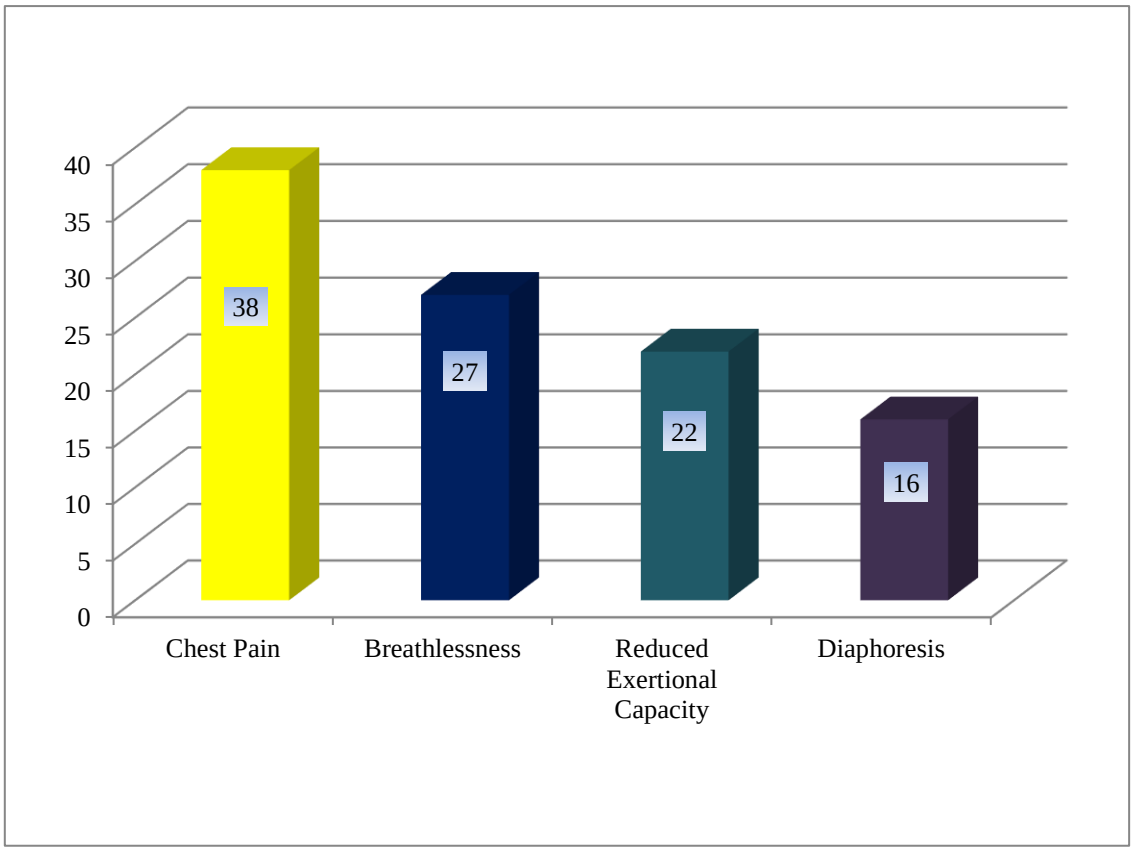

Figure 3: Presenting complaints in studied cases.

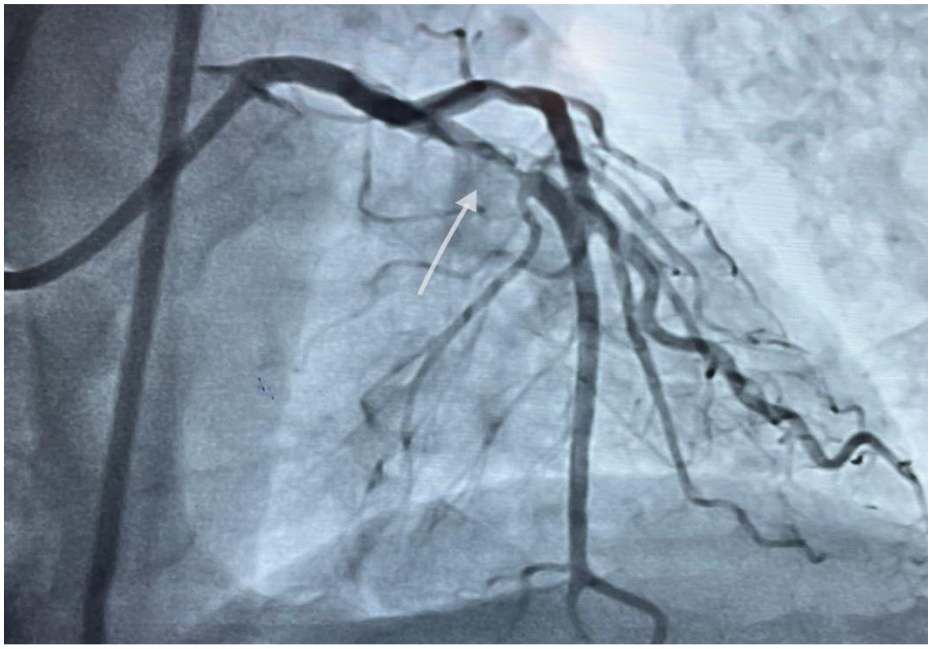

Figure 4: Proximal lad showing 90% stenosis (white arrow).

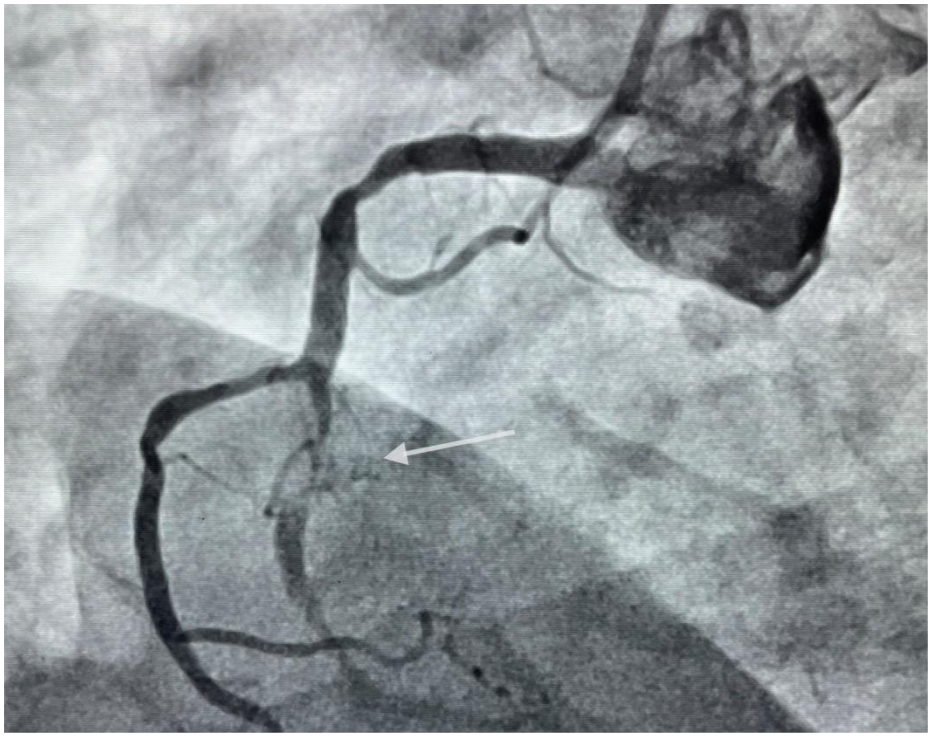

Figure 5: RCA showing proximal 70% stenosis followed by 95% thrombotic occlusion.

DISCUSSION

With increasing number of patients with COVID-19 there was increasing incidence of patients presenting with cardiac abnormalities including myocarditis, cardiac dysfunction and coronary artery disease. The mechanism by which COVID-19 patients developed cardiac complications was not exactly understood but endothelial and myocyte damage secondary to cytokine storm as well as direct toxic effect of corona virus on endothelial cells and myocytes had been postulated to be the cause of cardiovascular complications.

Cardiovascular involvement in COVID-19 patients was well known by now. There were case reports in which patients of COVID-19 was found to have cardiac involvement such as myocarditis, global myocardial inflammation, ventricular dysfunction and eventual cardiac failure. The pathogenesis of cardiac involvement was found to be multifactorial. Direct effect of virus by binding to viral receptor of myocyte as well as cytokine induced inflammation were 2 important factors responsible for cardiac toxicity as reported by many researchers including Riccardo et al and Saleh et al.[10,11]

Stefanini et al conducted a retrospective analysis in which data from all confirmed COVID-19 patients who underwent coronary angiography were analyzed. A total of 28 patients with COVID-19 were included in this study the majority had localized wall motion on echocardiography (82.1%). Of these patients, 17/28 (60.7%) had evidence of a culprit lesion requiring revascularization and 11 patients (39.3%) did not have obstructive coronary artery disease. The authors concluded that culprit lesion causing myocardial ischemia can be presenting complaint in COVID-19 patients. They further recommended that a dedicated diagnostic pathway should be delineated for COVID-19 patients with myocardial ischemia, aimed at minimizing patients' procedural risks and healthcare providers' risk of infection.[12]

There were other case reports which described occlusion of multiple coronary arteries in patients with COVID-19. Rey et al reported a case of 59 year old patient who suddenly developed chest pain and found to have ACS with ST-segment elevation in the lower leads. Coronary angiography was done which showed a severe lesion with abundant thrombotic content in the right coronary artery (RCA) and occlusion of the posterior descending (PD) and left anterior descending (LAD) arteries, with a moderate proximal lesion showing a filling defect consistent with thrombus.[13] Another case report by Dancy et al described a case of 51 year old male with hypertension, established type 2 diabetes mellitus and hypercholesterolemia who was found to have COVID-19 and complaints consistent with coronary artery disease. Coronary angiography revealed coronary artery thrombosis in this case also.[14]

Loffi et al retrospectively analyzed data from patients with COVID-19 between February and March 2020. In this study the authors analyzed data of 1252 consecutive patients with COVID-19, 124 (9.9%) had concomitant CAD. Patients with CAD were older and had a higher prevalence of comorbidities compared with those without CAD. Results were consistent among patients with prior myocardial infarction, prior percutaneous coronary intervention (PCI), prior coronary artery bypass grafting (CABG) or CAD. Multivariable analysis showed that age and female sex were the only two independent correlates of mortality. The authors concluded that patients with COVID-19 and CAD have an exceedingly higher risk of mortality. Though the authors attributed this increased risk to the underlying coronary artery disease rather than effect of COVID-19.[14]

CONCLUSION

Cardiovascular manifestation of COVID-19 are well known by now. Individuals with pre-existing systemic illnesses are more prone to develop these complications. A high index of suspicion and timely intervention is necessary to diagnose and manage coronary artery disease in post-covid patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Chhabra A, Shisode V, Rajput R. Coronary artery disease in post-COVID patients: a prospective study. Int J Res Med Sci 2021;9:2766-72.