# An unexpected cause of chest pain, dyspnea and palpitations in a young patient during a post-COVID syndrome

Fulvio Cacciapuoti[1], Ilaria Caso[1], Mario Crisci[2], Fabio Minicucci[3], Federico Cacciapuoti[4]

[1]Department of Cardiology, Monaldi Hospital, Naples; [2]Department of Interventional Cardiology, Monaldi Hospital, Naples; [3]Department of Cardiology, San Leonardo Hospital, Castellammare di Stabia, Naples; [4]Chair of Internal Medicine, University of Campania Luigi Vanvitelli, Naples, Italy

## Abstract

A 31-year-old male presented with sudden onset of chest pain and dyspnea after a COVID-19 infection. Initially labeled as a myopericarditis related to COVID-19, because of the young age and low risk profile, after a multiparametric evaluation was possible to diagnose and treat an unstable lesion on an intermediate branch of left coronary.

Correspondence: Fulvio Cacciapuoti, MD., Department of Cardiology, Monaldi Hospital, Via L. Bianchi s.n.c., 80100 Naples, Italy.
E-mail: fulvio.cacciapuoti@ospedalideicolli.it

Key words: COVID-19 infection; post-COVID syndrome; case report; NSTEMI; ECG; echocardiography; coronary angiography; optical coherence tomography.

Conflict of interest: the authors declare that they have no competing interests, and all authors confirm accuracy.

Ethics approval and consent to participate: no ethical committee approval was required for this case report by the Department, because this article does not contain any studies with human participants or animals. Informed consent was obtained from the patient included in this study.

Consent for publication: the patient gave his written consent to use his personal data for the publication of this case report and any accompanying images.

Received: 22 August 2022.
Accepted: 3 November 2022.
Early view: 14 November 2022.

Publisher's note: all claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article or claim that may be made by its manufacturer is not guaranteed or endorsed by the publisher.


*Licensee PAGEPress, Italy*
*Monaldi Archives for Chest Disease 2023; 93:2417*
*doi: 10.4081/monaldi.2022.2417*



## Introduction

Since its inception, coronavirus disease 2019 (COVID-19) has been shown to affect multiple organs and systems, apart from the lungs. It can progress to multi-organ failure (MOF) in its most advanced forms. Myocardial involvement in SARS-CoV-2 infection can be extremely variable [1] ranging from myopericarditis to acute coronary syndromes. In critically ill patients, troponin is often positive because of acute respiratory distress, inflammation, and coagulation disorders [2], even in the absence of significant coronary stenosis [3]. Previous studies reported the occurrence of myocardial involvement, defined as increased troponin levels and electrocardiographic abnormalities, among hospitalized COVID-19 patients [4].

Herein, we describe the case of a young man who developed acute coronary syndrome after a recent paucisymptomatic COVID-19 infection.

## Case Report

A 31-year-old man was admitted to the Emergency Room complaining of acute onset of chest pain with dyspnea and episodes of palpitations. He was double-vaccinated and recovered from a recent SARS-CoV-2 infection lasting two weeks, characterized by fever and mild respiratory symptoms and had a negativized swab 48 h before. The patient was a current smoker of about 3 cigarettes per day with no other cardiac risk factors and a negative family history of coronary artery disease. He was a runner and denied any past medical history. At cardiac physical examination, systolic and diastolic tones were reported with a pericardial friction rub. The arterial blood pressure was of 160/90 mmHg and his oxygen saturation was 97% on room air. The 12-lead ECG showed sinus rhythm with a heart rate of 80 bpm, normal PR interval and no sign of acute myocardial ischemia (Figure 1A). Initial differential diagnosis included pleuritis, pulmonary embolism, myopericarditis, acute coronary syndrome and aortic dissection. The bedside echocardiography reported hypokinesia of apico-lateral segments of left ventricle (LV) with a mildly reduced ejection fraction as determined with the biplane Simpson's method (LVEF%=43%) (Figure 2). Pericardial thickness and brightness were also present, so COVID-related myopericarditis was initially diagnosed; 250 mg of acetylsalicylic acid were administered i.v. with resolution of symptoms but, immediately after, an accelerated idioventricular rhythm (AIVR) established (Figure 1B). This rhythm disturbance was successfully treated with i.v. administration of magnesium sulfate (MgSO4) and metoprolol. Blood tests

revealed significantly increased values for high sensitivity Troponin I (>25000 pg/mL; normal range: 40.8-115.1), creatine kinase (>1300 U/L; normal range: 46-171) and creatine kinase-MB (>300 ng/mL; normal range: 0.5-3.6). D-dimer was within normal range, excluding pulmonary embolism, while C-reactive protein (1.8 mg/dL; normal range <1.0 mg/dL) and erythrocyte sedimen-

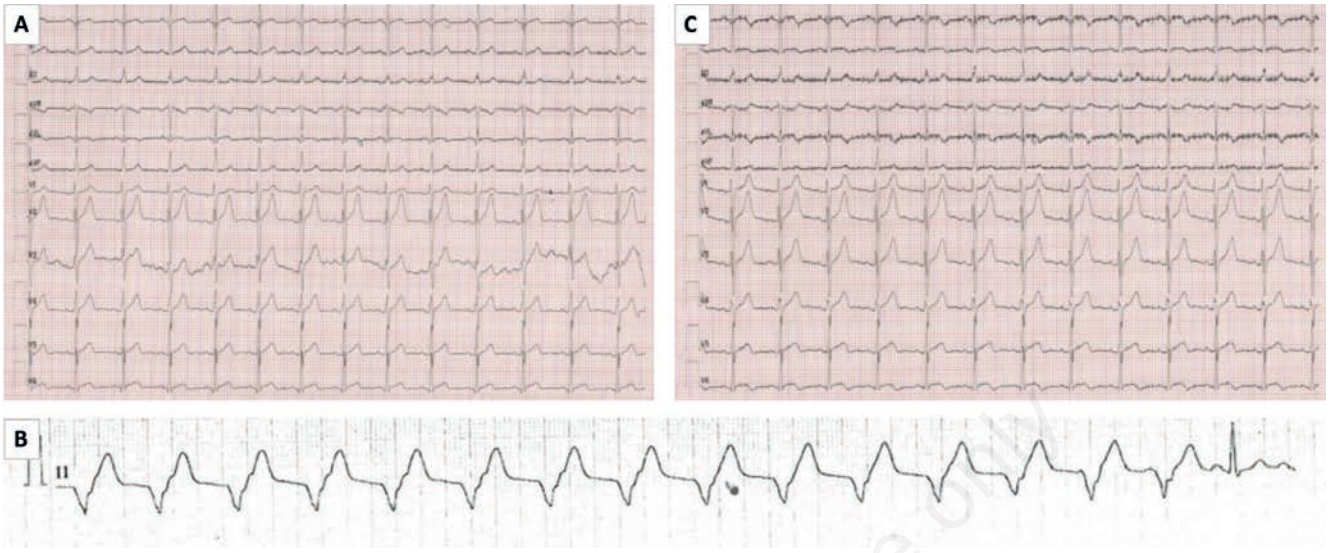


**Figure 1.** A) 12-lead ECG at ER admission: sinus rhythm with heart rate of 80 bpm; normal PR interval; no signs of acute myocardial ischemia. B) ECG strip: accelerated idioventricular rhythm (AVIR). C) 12-lead ECG: inversion of T waves in lateral leads.

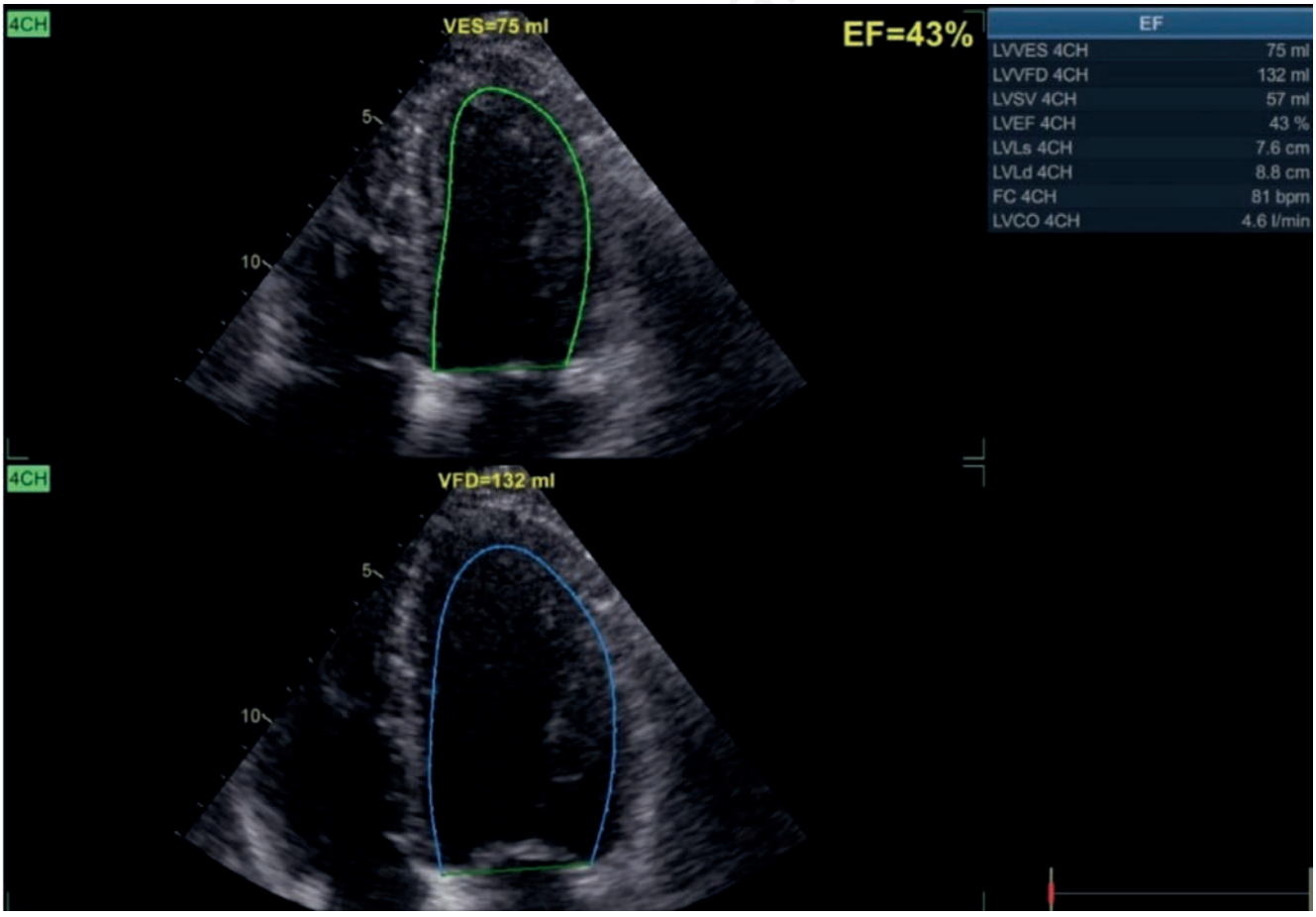


**Figure 2.** Bedside transthoracic echocardiography (TTE): ejection fraction calculated by biplane Simpson's method estimated at 43%.

tation rate (16 mm/h; normal range: 0-13 mm/h) were slightly increased. The patient was admitted to Cardiac Intensive Care Unit, monitored and a cardiac MRI was scheduled. A second 12-lead ECG showed an inversion of T waves with a flattening of the ST tract in lateral leads, suggesting the diagnosis of a subacute ischemic event (Figure 1C). The 3D ultrasound examination confirmed the akinesia of the apical segment of the left ventricular lateral wall (Figure 3), with hypokinesia of the anterior wall and a global strain (GS) of -12.3% (Figure 4). The patient underwent coronary angiography that revealed a significant plaque on an intermediate branch of the left coronary artery and a TIMI 3 flow (Figure 5A) while optical coherence tomography (OCT) showed a vulnerable plaque with a necrotic lipid core and contextual small intimal erosions (Figure 5B). Finally, in consideration of the insta-

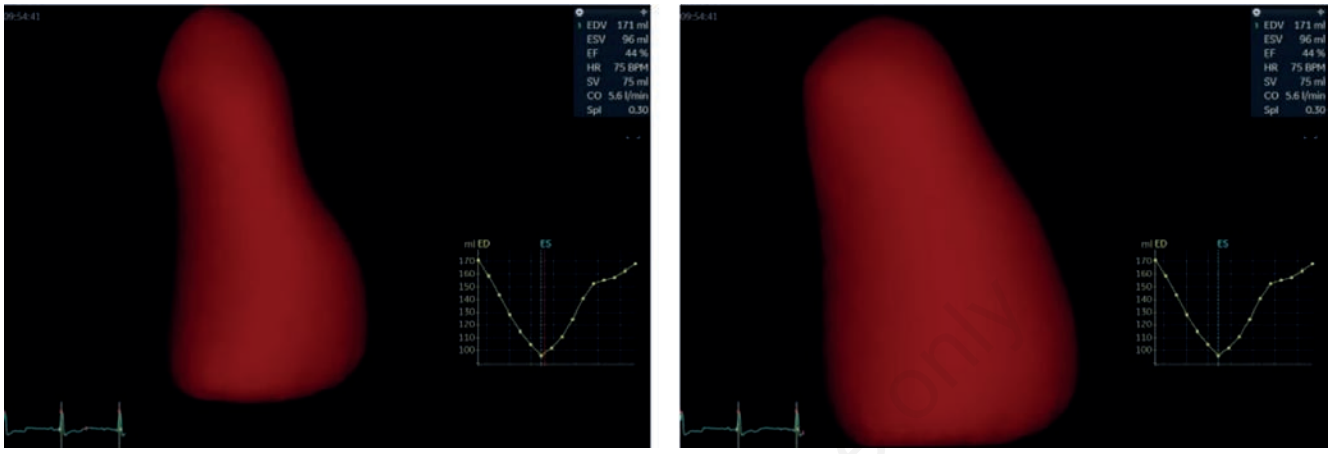


**Figure 3.** 3D-echocardiography: akinesia of apical segment of left ventricular lateral wall. Systole (left) and diastole (right).

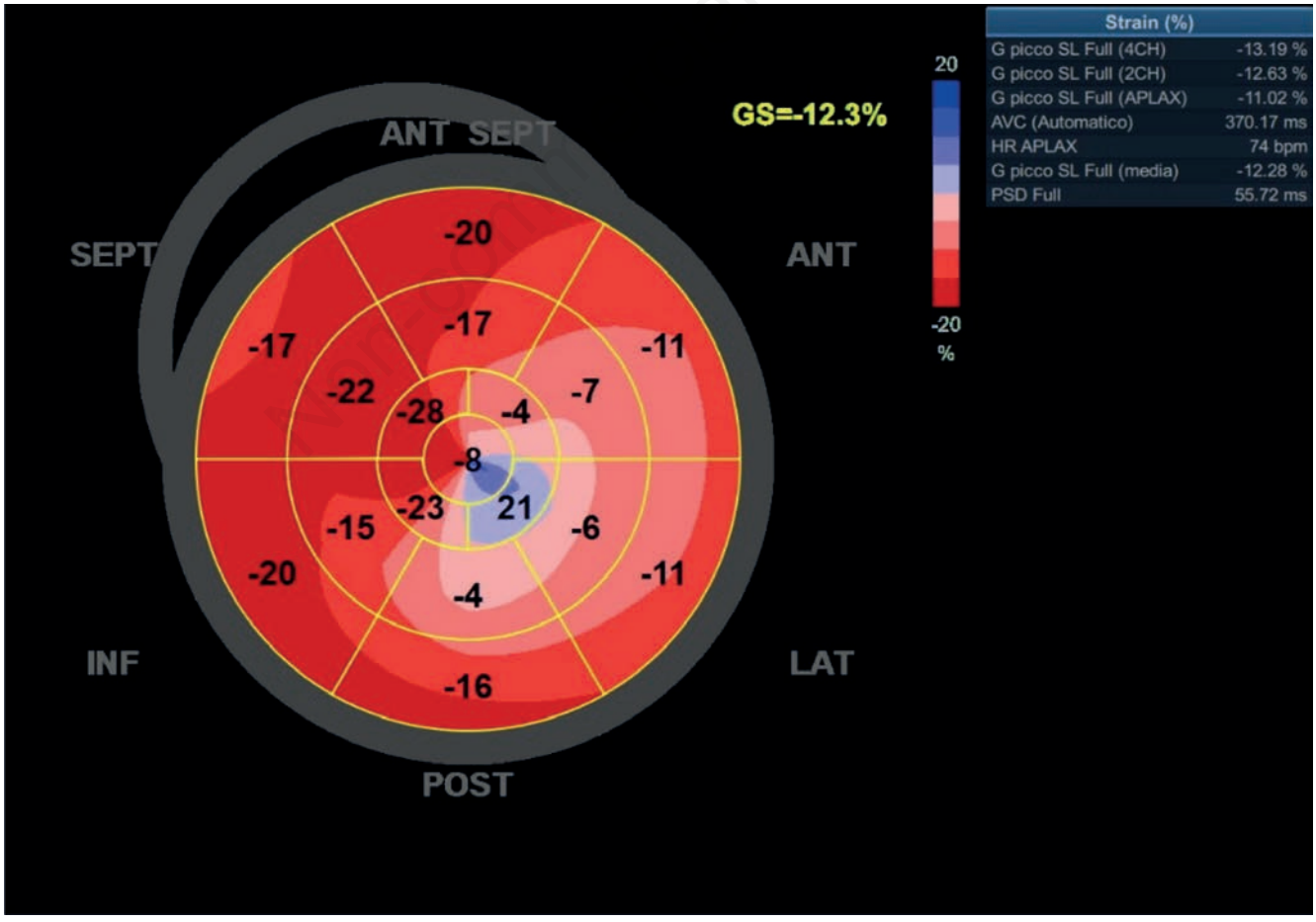


**Figure 4.** Global longitudinal strain of left ventricle: akinesia of apical lateral wall with hypokinesia of anterior wall. Global strain -12.3%.

bility characteristics of the plaque, percutaneous transluminal angioplasty (PTCA) with drug-eluting stent (DES) implantation was made and a dual antiplatelet therapy (DAPT) was started. The patient had a favorable clinical course and was discharged on the sixth day diagnosed with NSTEMI. In this scenario AIVR should be considered a "reperfusion arrhythmia" while the inflammation of pericardial leaflets could be considered an accessory finding, expression of the recent inflammatory state, so the cardiac MRI was cancelled. One month after discharge, echocardiographic follow-up showed complete resolution of pericardial thickening with the normalization of global and segmental kinesis of the left ventricle and a LVEF of 60%.

## Discussion

This case represents a relatively uncommon event in the context of post-COVID syndrome with a dramatic impact on the myocardium, which evolved into an acute coronary syndrome. Several points must be raised regarding acute myocardial infarction (AMI) occurring in post-COVID-19 infection, such as the role of inflammation, the imbalance of respiratory exchange, the procoagulative tendency, and the role of ACE-2 [5].

Systemic inflammation and "cytokine storm" favor endothelial dysfunction, responsible for platelets and tissue factor activation, with thrombi formation. Previous studies evidenced how high inflammation indices such as ferritin, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and interleukins (IL-8, IL-2R, IL-6) were related to the poorest outcome in COVID-19 hospitalized patients [6]. The inflammatory state caused by the viral infection activates the plaque's cells, causing them to produce metalloproteinases and some peptidases. As a result, the plaque may become unstable, disrupting its cap surface and causing acute coronary syndrome [7]. Moreover, inflammation also induces platelets' overactivation with an increased thromboxane synthesis and impaired fibrinolysis.

Another potential mechanism consists of the impaired balance (mismatch) between reduced oxygen supply and increased oxygen demand, in the setting of tachycardia, hypotension and hypoxemia due to respiratory insufficiency [8]. This imbalance between oxygen demand and availability is responsible for myocardial injury, *a fortiori* in patients affected by chronic coronary syndrome.

But a key role in acute coronary disease is also performed by ACE-2 receptor [9]. SARS-CoV-2 enters the host cell *via* ACE-2 which works as a receptor and is expressed at multiple sites such as lungs, kidneys, and heart. Specifically, that happens through subunit 1 of spike protein [10]. This allows the access of the virus in human cells, including alveolar cells in the lungs, myocardial and endothelial cells. The binding of the viral spike protein to the cardiac ACE-2 favors endothelial dysfunction and plaque instability, potentially leading to vasculitis, myopericarditis and even myocardial infarction [11]. Investigators underlined how influenza infections, and not only COVID-19, can be related to a raised risk of myocardial infarction even after recovery [12].

Among the various types of myocardial injuries associated with COVID-19, inflammation affecting the cardiac muscle and pericardial leaflets, known as myocarditis and pericarditis, respectively, is the most frequently observed. These conditions can result from both a systemic inflammatory response and direct damage caused by the virus itself [13]. On the contrary, the activation of the plasma coagulation cascade frequently causes acute myocardial ischemia. Coagulation and fibrinolytic impairment have been reported in

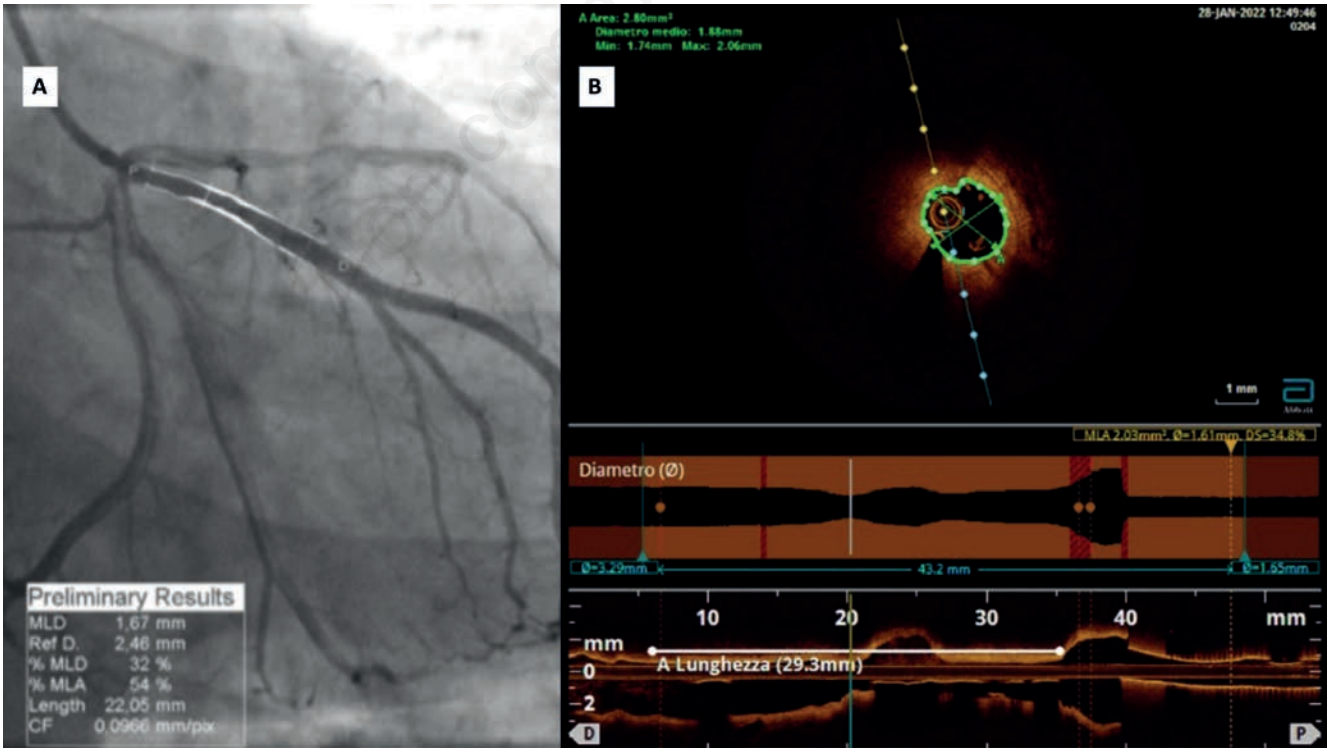


**Figure 5.** A) Coronary angiogram: significant plaque on intermediate branch of left coronary artery. B) Optical coherence tomography (OCT): fibrous plaque with presence of necrotic lipid core and contextual small intimal erosions.

COVID-19 patients [14]. The multiparametric evaluation in our patient allowed us to differentiate between NSTEMI and myopericarditis, which is also a potential complication in COVID-19 patients.

It should be noted that post-COVID syndrome, defined as the persistence of symptoms for more than three weeks following the acute phase of the infection, has been estimated to affect up to 35% of hospitalized patients [15).

## Conclusions

Close electrocardiographic, echocardiographic, and laboratory data monitoring in our case allowed us to distinguish acute coronary syndrome from an inflammatory form. In fact, the infection's pathophysiological stress slatentized a silent preexisting coronary artery disease, likely causing plaque destabilization and resulting in a "post-COVID coronary syndrome."

More research is needed to determine the cardiovascular risk and potential therapeutic options for protecting the myocardium following COVID-19 infection.

## References

1. Kapoor MC. Respiratory and cardiovascular effects of COVID-19 infection and their management. J Anaesthesiol Clin Pharmacol 2020;36:S21-8.
2. Joly BS, Siguret V, Veyradier A. Understanding pathophysiology of hemostasis disorders in critically ill patients with COVID-19. Intensive Care Med 2020;46:1603-6.
3. Hamilton MA, Toner A, Cecconi M. Troponin in critically ill patients. Minerva Anestesiol 2012;78:1039-45.
4. Guglin M, Ballut K, Ilonze O, et al. Clinical variants of myocardial involvement in COVID-19-positive patients: a cumulative experience of 2020. Heart Fail Rev 2022;27:1341-53.
5. Toscano O, Cosentino N, Campodonico J, et al. Acute myocardial infarction during the COVID-19 pandemic: An update on clinical characteristics and outcomes. Front Cardiovasc Med 2021;8:648290.
6. Long X, Zhang Z, Zou W, et al. Coagulopathy of patients with COVID-19 is associated with infectious and inflammatory markers. Risk Manag Healthc Policy 2020;13:1965-75.
7. Saed Aldien A, Ganesan GS, Wahbeh F, et al. Systemic inflammation may induce cardiac injury in COVID-19 Patients including children and adolescents without underlying cardiovascular diseases: A systematic review. Cardiovasc Revasc Med 2022;35:169-78.
8. Schiavone M, Gobbi C, Biondi-Zoccai G, et al. Acute coronary syndromes and Covid-19: Exploring the uncertainties. J Clin Med 2020;9:1683.
9. Zhu H, Zhang L, Ma Y, et al. The role of SARS-CoV-2 target ACE2 in cardiovascular diseases. J Cell Mol Med 2021;25:1342-9.
10. Ni W, Yang X, Yang D, et al. Role of angiotensin-converting enzyme 2 (ACE2) in COVID-19. Crit Care 2020;24:422.
11. Lei Y, Zhang J, Schiavon CR, et al. SARS-CoV-2 spike protein impairs endothelial function via downregulation of ACE 2. Circ Res 2021;128:1323-6.
12. Kwong JC, Schwartz KL, Campitelli MA, et al. Acute myocardial infarction after laboratory-confirmed influenza infection. N Engl J Med 2018;378:345-53.
13. Castiello T, Georgiopoulos G, Finocchiaro G, et al. COVID-19 and myocarditis: a systematic review and overview of current challenges. Heart Fail Rev 2022;27:251-61.
14. Connors JM, Levy JH. COVID-19 and its implications for thrombosis and anticoagulation. Blood 2020;135:2033-40.
15. Nalbandian A, Sehgal K, Gupta A, et al. Post-acute COVID-19 syndrome. Nat Med 2021;27:601-15.