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Name of Journal: *World Journal of Clinical Cases*

Manuscript NO: 77676

Manuscript Type: CASE REPORT

**Extensive Right Coronary Artery Thrombosis in a Patient with Coronavirus Disease
2019: A case report**

RCA Thrombosis in a COVID-19 Patient

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Abstract

BACKGROUND

Occurring in approximately 30% of hospitalized patients, cardiovascular complications that take place during the course of coronavirus disease 2019 (COVID-19) have been shown to cause morbidity and mortality. This case is the first report of extensive RCA thrombosis that was evaluated by intracoronary imaging and intracoronary invasive physiology in a patient with COVID-19.

CASE SUMMARY

Chief complaints

A 62-year-old woman presented with flu-like symptoms; ten days later she presented with inferior ST-segment elevations, chest pain, dyspnea, nausea, and vomiting.

Diagnoses

Diagnoses

The patient was diagnosed with COVID-19 following a positive test result, according to diagnoses timeline below:

Interventions

Emergency angiography of the right coronary artery (RCA) and its branches indicated intraluminal filling defects, suggesting a thrombus. Intravascular ultrasound confirmed subacute thrombus in the RCA, RPD branch, and RPV branch, an acute thrombus in the RVP branch, and atherosclerosis in the RCA. Dual antiplatelet/anticoagulation therapy was administered. After 7 days, angiography revealed complete disappearance of the thrombi. Optical coherence tomography confirmed this with the exception of a small thrombus in the RVP branch and atherosclerotic plaque in the RCA. The atherosclerotic RCA was measured using the resting full-cycle ratio, indicating no impairment to coronary physiology.

Outcomes

The patient was discharged on the eleventh day of hospitalization and remained asymptomatic through sixth-month follow-up.

CONCLUSION

This was the first report of RCA thrombosis in a patient with COVID-19. Dual antiplatelet/anticoagulation therapy was successful.

Key Words: Acute coronary syndrome, case-report, coronary angiography, COVID-19, intravascular ultrasound, thrombosis

DALL'ORTO CC, Lopes RPF, Cancela MT, Padilha CS, Pinto Filho GV, da Silva MR. Extensive Right Coronary Artery Thrombosis in a Patient with Coronavirus Disease 2019. *World J Clin Cases* 2022; In press

Core Tip: Cardiovascular complications occurring during the course of COVID-19 cause morbidity and mortality. We report ³ the case of a 62-year-old woman with COVID-19 and ST-elevation myocardial infarction. Angiography of the RCA suggested a thrombus, and findings were confirmed *via* intravascular ultrasound and optimal coherence tomography. Dual antiplatelet therapy and anticoagulation with enoxaparin therapy was administered for 7 days, followed by disappearance of the thrombi. Resting full-cycle ratio was performed without damage to coronary physiology. There is no consensus on the ideal management approach for ACS in this scenario; however, in this case the thrombi disappeared after dual antiplatelet and anticoagulation therapy.

INTRODUCTION

Cardiovascular complications occurring in the course of COVID-19 cause morbidity and mortality, and affect 30% of hospitalized patients^[1-3]. One possible explanation for the damage caused to the myocardium by SARS-CoV-2 involves hypoxia following

respiratory failure along with excessive inflammation, excess cytokines, angiotensin-converting enzyme 2 receptor expression downregulation, platelet activation, the coagulation cascade, endothelial cell injury, rupture of previously existing plaques (type 1 acute myocardial infarction [AMI]), and direct myocyte infiltration by the virus^[4-6].

CASE PRESENTATION

Chief complaints

Chest pain, dyspnea, nausea, and vomiting.

History of present illness

A 62-year-old woman initially presented with flu-like symptoms, and was diagnosed with COVID-19 following a positive reading on a polymerase chain reaction (PCR) test. Ten days later, the patient presented with chest pain, dyspnea, nausea, and vomiting.

History of past illness

The patient's medical history included dyslipidemia and incipient atherosclerosis in the carotid and aortic territories, continuous use of nortriptyline for migraines, and 9 years of tiboline (Libiam 1,25 mg once a day [Libbs - São Paulo - SP/BR]) as menopausal hormone therapy.

Personal and family history

The patient's medical history included dyslipidemia and incipient atherosclerosis in the carotid and aortic territories, continuous use of nortriptyline for migraines, and 9 years of tiboline (Libiam 1,25 mg once a day [Libbs - São Paulo - SP/BR]) as menopausal hormone therapy.

The patient had received three doses of a vaccine for SARS-CoV-2; two chimpanzee adenovirus vector vaccines (ChAdOx1 nCoV-19 AZD1222; Oxford/AstraZeneca/Fiocruz, Rio de Janeiro, Brazil) on 04/12/2021 and 07/13/2021

respectively, and one BNT162b2 mRNA COVID-19 vaccine (BioNTech/Pfizer, New York City, NY, USA) on 12/13/2021.

1 *Physical examination*

Upon physical examination the vital signs were as follows: Body temperature, 36.5°C; blood pressure, 122/78 mmHg; heart rate, 82 beats per min; respiratory rate, 22 breaths per min. The patient's clinical presentation was compatible with Killip-Kimball grade I classification

Laboratory examinations

Blood cardiac biomarkers included creatine kinase: 6105 IU/L, creatine kinase myocardial band fraction: 300 IU/L, and cardiac troponin I: 25 000 pg/mL. In addition, transthoracic Doppler echocardiography revealed akinesis in the inferior mid-basal and apical infero-basal portions of the left ventricle.

Imaging examinations

Graphic methods

Electrocardiography showed sinus rhythm, inferior ST-segment elevations, and reciprocal changes in the anterolateral leads (Figure 1). The patient was referred for emergency angiography.

Imaging examinations

Emergency coronary angiography revealed that the **4** anterior descending coronary artery and its diagonal branches and the circumflex artery and its marginal branches were free of obstructive atherosclerotic lesions (Figure 2). However, images of the right coronary artery (RCA) and its right posterior descending (RPD) and right posterior ventricular (RPV) branches indicated defects in intraluminal filling, suggesting a thrombus (Figure 3).

FURTHER DIAGNOSTIC WORK-UP

We evaluated the RCA by intracoronary ultrasound. Intravascular ultrasound (IVUS) pullbacks were performed using a 40 MHz IVUS OPTICROSS catheter (Boston Scientific, Natick, MA, USA) at 0.5 mm/s. The images suggested a subacute, homogeneous, echolucent thrombus in a large extension of the RCA, RPD branch, and RPV branch. Additionally, they showed an acute thrombus with a bright aspect, clear outline, and no signal attenuation in the RVP branch (Figure 4)^[7]. We also identified mild to moderate atherosclerosis in the middle third of the RCA (Figure 3).

FINAL DIAGNOSIS

The patient was diagnosed with acute myocardial infarction with inferior ST-segment elevations, Killip grade I heart failure, and COVID-19.

TREATMENT

Upon angiogram, the patient was pain-free and had thrombolysis in myocardial infarction 3 flow, despite extensive thrombotic burden in RCA. Therefore we did not perform primary angioplasty, and instead opted for dual antiplatelet therapy with ticagrelor and aspirin and anticoagulation therapy with enoxaparin 1 mg/kg twice a day. Additionally, we administered the pharmacology recommended by current guidelines for patients with acute myocardial infarction with ST-segment elevation, including statins, a beta-blocker, an angiotensin-converting enzyme or angiotensin II receptor blocker, and a mineralocorticoid receptor antagonist^[8-10].

OUTCOME AND FOLLOW-UP

After 7 days, repeat coronary angiography showed completely disappearance of the thrombi located in the RCA and its branches (Figure 5). Therefore, we performed intravascular optical coherence tomography (OCT) for confirmation, using the ILUMIENTM OPISTM, OPTIS Integrated, and OPTIS Mobile systems (Abbott Vascular, Santa Clara, CA, USA) with a rapid exchange catheter (Dragonfly™ DUO, Dragonfly™ OPISTM, and Dragonfly OpStar™ Imaging Catheter; Abbott Vascular,

Santa Clara, CA, USA) with a 75 mm/2.1 s (36 mm/s) pullback and 180 frames/s. The OCT exam confirmed that the thrombi had disappeared, with the exception of a small residual thrombus in the RVP branch (Figure 6). It also identified a plaque in the middle third of the RCA. Severity of coronary stenosis was measured using the resting full-cycle ratio, a non-hyperemic index based on unbiased detection of the lowest existing relationship between distal coronary pressure and aortic pressure (Pd/Pa), independent of the electrocardiogram, landmark identifications, and time within the heart cycle. We evaluated this plaque as 40% mild in the RCA, causing 40% arterial lumen obstruction. We used PressureWire X (Abbott Vascular, Santa Clara, CA, USA), which reported a value of 0.99 (Figure 7), indicating the absence of impairment to coronary physiology.

The patient recovered without further event and was discharged on the eleventh day of hospitalization. After showing good tolerance to medications with no adverse effects, she was prescribed ticagrelor, aspirin, statins, beta-blockers, and angiotensin-converting enzyme inhibitors.

DISCUSSION

The common occurrence of extra-respiratory involvement in SARS-CoV-2 infections has become more evident over time. AMI with ST-segment elevation are seen with a pattern on angiography, and extensive thrombosis can affect one or more coronary arteries and different vascular territories simultaneously, not caused by rupture of atherosclerotic plaques. These occurrences present new challenges to treating and managing this virus^[10,11]. The increased incidence of stent thrombosis may be associated with these phenomena, and severe inflammation with consequent hypercoagulation is another primary pathology associated with SARS-CoV-2 ^[12].

In the present case, the hypothesis of AMI with ST-segment elevation was confirmed by clinical findings, electrocardiogram, laboratory blood tests, and coronary angiography. The latter showed extensive failure of intraluminal filling suggesting a thrombus, which was then confirmed by IVUS and OCT findings. The plaque in the middle third of the RCA, which we believe was not responsible for the event, did not

cause any hemodynamic repercussions, a fact confirmed by the assessment of invasive physiology.

While the importance of differentiating between type I and type II AMI and myocarditis in patients with COVID-19 presenting with acute coronary syndrome (ACS) is established, there is no consensus on the ideal management approach for ACS in this scenario. Percutaneous coronary intervention, aspiration, and antiplatelet thrombectomy are options, with the latter being the most generally agreed upon for treating these patients^[13]. However, in this study, the thrombi disappeared after dual antiplatelet therapy, anticoagulation therapy, and traditional post-MI pharmaceutical interventions were administered.

CONCLUSION

This was the first report of extensive RCA thrombosis in a patient with COVID-19 evaluated by intracoronary imaging and intracoronary invasive physiology.

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