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COVID-19 induced type 2 myocardial infarction in a patient with unknown severe coronary artery disease

Infarto agudo do miocárdio tipo 2 induzido por COVID-19 em paciente com doença arterial coronariana grave desconhecida

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ABSTRACT – Myocardial infarction is well described in the COVID-19 pandemic and specific protocols should be developed in the context of acute management of this condition. The relation between myocardial injury and death is well established in the literature and is associated with an increased need for invasive ventilation and other complications. Type 2 myocardial infarction and new onset of heart failure have been diagnosed more frequently in the setting of COVID-19. Particular emphasis should be placed on timing for invasive procedures, such as coronary interventions and coronary artery bypass graft in a SARS-CoV2 positive. We describe a case of a COVID-19 patient with no past cardiac history, who was admitted with symptoms of heart failure and markers of myocardial injury, suggestive of type 2 myocardial infarction.

Keywords: COVID-19; Coronavirus infection; Myocardial injury; Myocardial infarction; Coronary artery disease

RESUMO – O infarto agudo do miocárdio está amplamente descrito na pandemia de COVID-19, e protocolos específicos devem ser elaborados no contexto do manejo agudo dessa condição. A relação entre injúria miocárdica e morte é bem estabelecida na literatura, estando associada a maior necessidade de ventilação invasiva e a outras complicações. O infarto agudo do miocárdio tipo 2 e a insuficiência cardíaca aguda nova são diagnosticados com maior frequência no contexto da COVID-19. Deve-se dar ênfase ao tempo ideal para procedimentos invasivos, tais como intervenção coronária percutânea e revascularização do miocárdio em pacientes positivos para SARS-CoV-2. Descrevemos o caso de uma paciente portadora de COVID-19 sem histórico de doença cardíaca prévia, admitida com sintomas de insuficiência cardíaca, apresentando marcadores de injúria miocárdica sugestivos de infarto agudo do miocárdio tipo 2.

Descritores: COVID-19; Infecção por coronavírus; Injúria miocárdica; Infarto do miocárdio; Doença da artéria coronariana

INTRODUCTION

Coronavirus disease 2019 (COVID-19), which was first reported in late December in Wuhan, province of Hubei, in China, was declared a pandemic, by the World Health Organization (WHO) on March 11, 2020, and, in early September 2020, it had infected more than 27 million people worldwide, and affected the healthcare system considerably, including Cardiology, a specialty that deals with both urgent and elective patients.^{1,2} Analysis of studies from Wuhan showed a case fatality rate of 2.3%; however it reached 10.5% in individuals with cardiovascular disease.³ Myocardial injury occurs in 7% to 20% of patients with COVID-19 and may be due to disease severity, myocarditis, or type 1 and 2 myocardial infarction (MI).^{3,4} The correct distinction and treatment of those conditions might change the course of disease. We describe the case of a patient with no past cardiac history, positive for COVID-19, with symptoms of cardiac failure and markers of myocardial injury, suggestive of type 2 MI.

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CASE REPORT

We report a case of a 55-year-old woman who arrived at the emergency department with a history of 5-day progression of resting dyspnea, dry cough, swelling and pain in the lower limbs, and uncharacteristic abdominal pain. She was known to have diabetes, on regular use of metformin 850mg three times a day, and glibenclamide 5mg twice a day. Initial evaluation revealed lower limb edema, blood pressure of 100/70mmHg, heart rate of 98 beats per minute, respiratory rate of 22 breaths per minute, temperature of 36°C, and oxygen saturation of 90% with no oxygen supplementation. The initial laboratory tests showed hemoglobin 11.4g/dL, leukocytes 6,330/mm³, lymphocytes 1,481/mm³, creatinine 1.26mg/dL, blood glucose 404mg/dL, C-reactive protein 12.9mg/L, metabolic acidosis in arterial blood gas, and hypoxemia with partial pressure of oxygen of 59mmHg. Besides, other laboratory tests revealed ultrasensitive troponin 1,790pg/mL, brain natriuretic peptide 1,170pg/mL, D-dimer 1,580ng/mL, alanine aminotransferase 264U/L (normal range 52U/L) and aspartate transaminase 69U/L (normal range 39). Chest X-ray evidenced patchy perihilar infiltrates, right pleural effusion, and lower right lobe consolidation and 12 lead electrocardiogram (ECG) showed sinus rhythm with an anterior wall electrical inactivity (Q waves in V1-V5 leads). She was started on intravenous azithromycin 500mg q.d., plus ceftriaxone 1g b.i.d., furosemide 40mg t.i.d, a nasal cannula for oxygen support, and thromboembolism prophylaxis.

Due to pandemic timing, oral and nasopharyngeal swabs for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) reverse transcription - polymerase chain reaction (RT-PCR) were collected, and tested positive.

The dual antiplatelet therapy (aspirin and clopidogrel) was initiated in day 1, and further measures of cardiac troponin showed a decrease in values with 1,460pg/mL in day 2, and 888pg/mL in day 3. Chest computed tomography (CT) was performed in day 1 and showed right pleural effusion, air bronchograms with lower right lobe consolidation, and bilateral ground-glass opacifications, with interlobular septal thickening (Figures 1A and 1B). Computed tomography additionally showed important calcification in the proximal left anterior descending artery (LAD) (Figures 1B and 1C). Due to the occurrence of myocardial injury during COVID-19, and the finding of a calcified coronary artery in CT in a diabetic patient, a cardiac magnetic resonance (CMR) was performed on day 6 to further elucidate differential diagnosis. It showed increased left ventricle (LV) end-diastolic volume, reduced LV ejection fraction (LVEF) of 33%, akinesia in the mid

Figure 1. Chest computed tomography. Panels A and B showing pulmonary infiltrates with consolidation and bilateral ground-glass opacification. Bilateral pleural effusion, predominantly on the right. Red arrows in panels B and C show severely calcified left anterior descending artery.

and apical segments of the anterior wall, and perfusion defect with viability in the LV anterior wall. The diagnosis of type 2 MI was made, probably due to oxygen supply-demand mismatch, in a high-risk patient with probable unknown coronary artery disease. The patient underwent invasive strategy with coronary angiography performed

on day 7, after onset of symptoms, with the cath lab team fully equipped with Personal Protective Equipment (PPE) for aerosols and droplets. The catheterization evidenced a highly calcified proximal LAD and total occlusion in its mid-segment, without acute aspect, with grade II collateral supply; severe lesions in the circumflex artery and its obtuse marginal branches; and severe diffuse right coronary lesion (Figure 2 and Videos 1 and 2). Based on three-vessel coronary arterial disease (CAD), with high complexity lesions, SYNTAX I score of 35 and reduced LVEF, Heart Team decided that ideally, treatment should be coronary artery bypass graft during the hospitalization period. According to the Heart Team and infectious disease specialists, consensus was to wait for a minimum of 21 days after onset of respiratory symptoms for the

cardiac surgery, reducing the spreading of the virus at the workplace and to the cardiovascular healthcare workers involved in treatment. Clopidogrel was discontinued on day 13 and the patient remained asymptomatic during the waiting period. The patient underwent coronary artery bypass graft with left internal thoracic artery to LAD and saphenous vein to obtuse marginal branch. She was discharged from the intensive care unit 2 days after the procedure without complications, and was further discharged from hospital to outpatient follow-up 6 days after the procedure, remaining asymptomatic from cardiovascular or respiratory symptoms. Two weeks after discharge, none of the cardiovascular care team tested positive for SARS-CoV-2.

Figure 2. Coronary angiography. Panels A, B and C show left coronary artery, with severe lesions in circumflex artery and its important obtuse marginal branches, severely calcified occlusion of left anterior descending artery in its mid segment. Yellow arrows demonstrate discrete intracoronary collateral (grade 1) to left anterior descending artery. Panel D shows diffuse disease in right coronary artery, also involving its distal branches. Dashed yellow line shows intercoronary collateral (grade 2) to left anterior descending artery distal bed.

Video 1. Coronary angiogram in right anterior oblique projection with caudal angulation, demonstrating severe arterial coronary disease, with chronic left anterior descending artery occlusion in its mid segment, intracoronary collaterals for left anterior descending and severe lesions in the circumflex artery and its obtuse marginal branches.

Video 2. Right coronary artery catheterization in cranial projection, shows severe diffuse obstructions, mainly in the proximal and distal segments, also involving its distal branches. Rich inter-coronary collaterals supply the left anterior descending.

DISCUSSION

COVID-19 is known to affect the cardiovascular system in distinct forms, such as myocardial injury, cardiac arrhy-

thmias, myocarditis, heart failure, and shock.⁵ In a study comparing surviving cases with deaths, elevated ultra-sensitive troponin was found in more than 50% of deaths, with findings of acute cardiac injury, defined as serum levels of cardiac biomarkers were above the 99th percentile upper reference limit, or new abnormalities were shown in ECG or echocardiography, in up to 12% of cases.⁶ The relation between myocardial injury and death was described in a study with 416 hospitalized patients, median age of 64 years and 50.7% female patients. Myocardial injury was present in 82 (19.7%) patients and was associated with increased mortality (42 [51.2%] *versus* 15 [4.5%]; $p < 0.001$) with a hazard ratio of 4.26 (95%CI 1.92-9.49; $p < 0.001$) in multivariate analysis. It was also associated with an increased need for invasive ventilation and complications, such as acute respiratory distress syndrome, acute kidney injury, electrolyte disturbances, and coagulation disorders.⁴ Cardiac magnetic resonance appears most appropriate in patients with clinically suspected acute myocardial injury, and serologic evidence of cardiomyocyte damage with troponin elevation. Cardiac magnetic resonance can differentiate between ischemic and non-ischemic etiologies, such as myocarditis, and further demonstrate the extent and severity of the injury and its impact on ventricular function.⁷ Best timing for a diagnostic coronary angiogram is fundamental during the COVID-19 pandemic period, and should be based on the patient cardiovascular risk profile, local and cath lab risk of contamination, and availability of PPE.^{5,8,9} Percutaneous coronary intervention (PCI) may be considered over coronary artery bypass graft in selected complex anatomy, with full-PCI or even hybrid revascularization coronary artery bypass graft/PCI on the table for heart team consideration, based on patients clinical status and local situation.⁸ As reported, considering the patient's cardiovascular risk, respiratory stability, and local protocols, a coronary angiogram was performed at the end of daily shift, with all the cath lab staff ready with PPE, and decontamination protocols followed procedure.⁹ Due to the highly complex anatomy, not initially eligible for conservative or percutaneous treatment, coronary artery bypass graft was chosen and the Heart Team decided to an in-hospital watchful waiting until later period for the procedure, since the need of intubation, surgical ward usage, and intensive care unit stay, might increase the risk for contamination in early post-infection setting, but also coronary artery bypass graft further deferral risks might be even more pronounced. In this particular case, the heart team and the infectious diseases specialists decided to wait for 21 days, from onset of symptoms, to perform coronary artery bypass graft, which is the median duration of viral shedding.¹⁰ It is noteworthy that surgery should be carried out by a minimum number of healthcare providers, and the staff member is recommended to be the most experienced, and attention to infection mitigation strategies should be drawn, in the operating room and surgery recovery ward, to avoid and reduce risks of contamination to other patients and health workers.^{5,7,8,11}

Management of complex coronary artery disease presenting with MI during the COVID-19 pandemic is challenging. Correct diagnosis and initial infection management, with PPE and RT-PCR diagnostic tests, followed by adequate hospital protocols for diagnosis and surgical approach, help decide the best timing for invasive diagnostic procedures and definite treatment, with a full recovery from both COVID-19 and multivessel coronary disease.

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None.

CONFLICTS OF INTEREST

The authors declare there are no conflicts of interest.

CONTRIBUTION OF AUTHORS

Conception and design of the study: FBF, RLS and RMJ; data collection: FBF, RV and RMJ; data interpretation: FBF, RLS, RMJ and TF; text writing: FBF, RLS and RMJ; approval of the final version to be published: FBF, RLS, RV, TF and RMJ.

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