Folia Cardiologica 2021
vol. 16, no. 4, pages 263–268
DOI: 10.5603/FC.a2021.0033

ISSN 2353–7752
e-ISSN 2353–7760

COVID-19 pandemic dilemmas: acute coronary syndrome, viral myocarditis or both?

Dylematy czasu pandemii COVID-19 — ostry zespół wieńcowy, wirusowe zapalenie mięśnia sercowego czy jedno i drugie?

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Abstract

In December 2019, a new virus was identified — severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which quickly became the cause of a global pandemic. Due to the high infectivity of this virus, it was necessary to develop specific patterns of management for patients with acute cardiac problems dangerous to their health and life, associated with this pathogen. We present a middle-aged female infected with SARS-CoV-2, where acute coronary syndrome (ACS) was suspected due to reported chest pain, elevated cardiac markers and the presence of risk factors for ischemic heart disease. However, the coronary angiography did not show any atherosclerotic changes and, therefore, myocardial infarction with non-obstructive coronary arteries was diagnosed. Myocarditis secondary to SARS-CoV-2 infection could be a possible cause of ACS during coronary disease 20219 pandemic.

Key words: COVID-19, acute coronary syndrome, myocarditis, MINOCA, case report

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Introduction

In 2020 the disease caused by a new coronavirus, SARS-CoV-2 (severe acute respiratory syndrome coronavirus 2), coronavirus disease 2019 (COVID-19), quickly spread to most regions of the world, causing not only numerous deaths but also significant changes to the health care systems in many countries [1, 2].

SARS-CoV-2 causes lower respiratory tract infections, with a potentially severe course, especially in people with older age and the presence of comorbidities such as obesity, hypertension (HTN), diabetes, heart failure, and cancer [3]. In the new epidemic situation, it has become difficult to maintain the proper standards of management in patients with life-threatening heart diseases accompanied by SARS-CoV-2 infection [4]. Previous logistical health care dilemmas — present before COVID-19 — coupled with the newer challenges of managing these patients [4–6].

Case report

A 43-year-old obese woman [body mass index (BMI) = = 33.5 kg/m^2), with HTN and hypothyroidism was admitted urgently on November 6, 2020 to the Department of Cardiology, Interventional Electrocardiology and Hypertension at Jagiellonian University Medical College Hospital, Kraków, Poland from one of the district hospitals for further diagnosis and treatment. The patient reported pain in the

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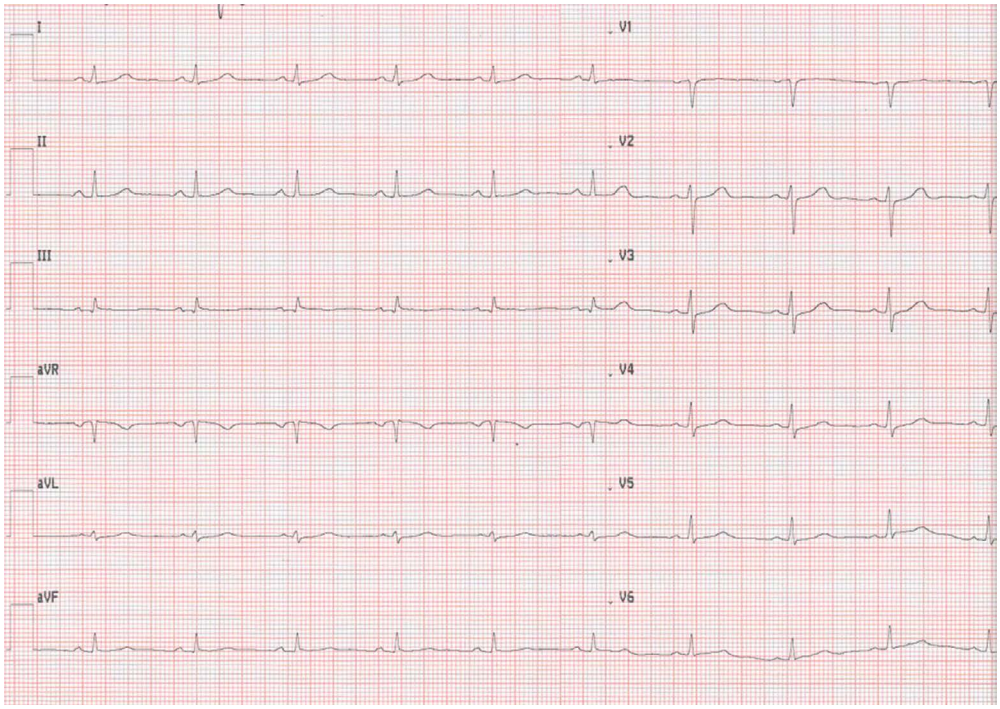

Figure 1. Electrocardiogram on admission. Regular sinus rhythm, frequency approx. 70/min. Axis not deviated. PQ = 160 ms. QRS = 90 ms. QT = 400 ms. No significant changes to the ST-segment

chest that occurred the previous day, at rest. It radiated to the left upper limb, then subsided and recurred several times. From 2–3 days before this episode, the woman generally felt worse, had a dry cough, slight dyspnoea and no fever. The onset of COVID-19 symptoms (cough, fever up to 39°C and weakness) were on October 21, 2020. The first positive polymerase chain reaction test was on October 22, 2020.

During a 24-hour stay at district hospital, the concentration of troponin I was elevated (values increasing from 317 ng/L to 1,087 ng/L, the norm < 9 ng/L). The concentration of C-reactive protein (CRP) was normal and the D-dimer concentration was slightly increased. In the electrocardiogram (ECG), the sinus rhythm was about 75/min, without any significant deviations from the norm, blood pressure was also normal. Due to the persistence of chest discomfort, she was treated with morphine intravenously (i.v.) with a good effect, low-molecular-weight heparin (LMWH) 1 × 60 mg subcutaneously (s.c.), acetylsalicylic acid (ASA) 75 mg orally and dexamethasone 1 × 8 mg i.v. Previous treatment of the patient (for 2 years) included levothyroxine 100 µg, indapamide with prolonged release 1.5 mg, bisoprolol 5 mg and lercanidipine 20 mg all once daily.

At admission to our Department, the patient was in a good general condition with slight chest discomfort (5/10). The arterial blood pressure was 146/80 mm Hg, pulse 70/min, blood saturation 98% without oxygen therapy, and body temperature 36.6°C. There were no peripheral edema. The ECG recorded on admission is shown in Figure 1, and the results of laboratory tests in Table 1. The echocardiography revealed normal global contractility of the left ventricular muscle with an ejection fraction (EF) of about 65%, without segmental abnormalities of contractility. There were no signs of aortic dissection or valve defects as well as no fluid in the pericardial sac. Echocardiographic images in two projections are presented in Figures 2 and 3. The chest X-ray is shown in Figure 4.

Due to the overall clinical presentation, a history of chest pain, significantly elevated levels of highly-sensitive troponin (at admission 1,456 ng/L, normal < 47.3 ng/L), elevated N-terminal pro-B-type natriuretic peptide (NT-proBNP) concentration and presence of risk factors for ischemic heart disease (obesity, HTN), the patient was referred to the hospital's CATH lab and qualified for invasive diagnosis of coronary vessels. Several hours before the procedure, the woman received aspirin 1 × 300 mg, atorvasterol 1 × 80 mg, and LMWH 1 × 80 mg s.c. However, the coronary angiography showed no atherosclerotic changes in the epicardial arteries and no signs of slow peripheral blood flow.

In the following days, the patient was in good condition, without coughing and with a normal body temperature. Blood pressure ranged from 116–128/80–84 mm Hg. LMWH treatment was continued with 80 mg once daily s.c. Atorvastatin 80 mg, lercanidipine 20 mg, bisoprolol 5 mg

Table 1. The results of the patient's laboratory tests on admission and on discharge

Tests [unit]	Results on admission	Results on discharge	Normal range
Leukocytes [×10^3/μL]	7.26	5.43	4.0–10.0
Hemoglobin [g/dL]	12.5	12.0	12.0–16.0
Hematocrit [%]	38.8	36.6	37.0–47.0
Platelet count [×10^3/μL]	481	394	140–440
Natrium [mmol/L]	138	138	136–145
Potassium [mmol/L]	4.30	4.57	3.50–5.10
Urea [mmol/L]	3.21	5.56	2.76–8.07
Creatinine [μmol/L]	68.0	77.2	62.0–106.0
GFR, MDRD [ml/min/1.73 m^2]	87	75	> 90
APTT [s]	34.1	–	26.0–36.0
INR	1.02	–	0.90–1.20
Glucose [mmol/L]	4.41	4.11	3.30–5.60
Troponin I hs [ng/L]	1,456.1	570.93	< 47.3
CK [U/L]	131	–	26–192
CK-MB mass [ng/mL]	4.44	1.71	< 5.00
LDH [U/L]	287	353	135–214
CRP [mg/L]	2.41	2.00	< 5.00
Procalcitonin [ng/mL]	< 0.02	< 0.02	< 0.10
Interleukin 6 [pg/mL]	6.66	–	< 7.00
Ferritin [μg/L]	28	–	13–400
Myoglobin [μg/L]	40	–	< 110
D-dimers [mg/L]	0.81	0.68	< 0.55
NT-proBNP [pg/mL]	444	38	< 125
ALT [U/L]	55	44	10–35
AST [U/L]	40	34	10–35
TSH [μIU/mL]	1.720	–	0.270–4.200
Total cholesterol [mmol/L]	–	3.5	3.2–5.2
HDL-cholesterol [mmol/L]	–	0.97	> 1.2
LDL-cholesterol [mmol/L]	–	2.0	< 3.4
Triglycerides [mmol/l]	–	1.29	< 2.26

ALT – alanine aminotransferase; APTT – activated partial thromboplastin time; AST – aspartate aminotransferase; CK – creatine kinase; CK-MB mass – creatine kinase myocardial bound; CRP – C-reactive protein; GFR – glomerular filtration rate; HDL – high-density lipoprotein; INR – international normalized ratio; LDH – lactate dehydrogenase; LDL – low-density lipoprotein; MDRD – Modification of Diet in Renal Disease program; NT-proBNP – N-terminal pro-B-type natriuretic peptide; TSH – thyrotropic hormone

also were all given once daily. Physical rehabilitation was performed.

There was complete relief from the reported chest discomfort and a decrease in troponin levels, and still there were no significant changes in subsequent ECGs. The results of laboratory tests of the patient on the day of discharge from the Cardiology Department are presented in Table 1. The patient was discharged home after 3 days and on Day 19 from the first positive swab for SARS-CoV-2. The woman did not require further isolation [7]. The diagnosis of myocardial damage was made, possibly secondary to viral infection.

Discussion

In the described woman with COVID-19, an acute coronary syndrome (ACS) was initially suspected (chest pain and increase/decrease in blood cardiac troponin concentration were found), most likely in the form of a non-ST-segment elevation myocardial infarction (NSTEMI). Due to the existing risk factors (HTN, obesity, hypothyroidism), she was suspected having atherosclerotic lesions in the coronary arteries [8]. However, there were no ischemic changes on the ECG, no loss of myocardial viability (echocardiography), or blood flow disturbances on angiography [no thrombus in

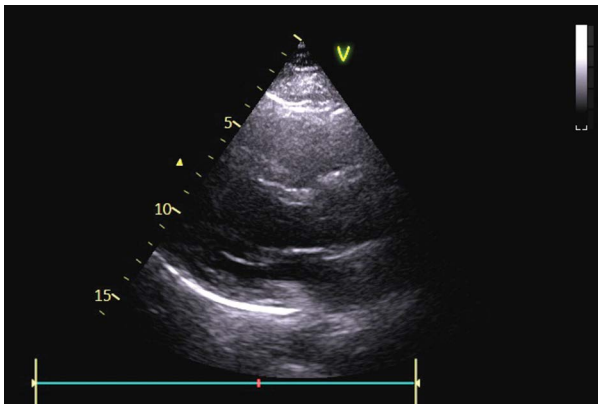

Figure 2. Echocardiography in the parasternal long axis projection. Normal dimensions of the left ventricle, left atrium, right ventricle and aorta are visible. Heart walls of normal thickness. No fluid in the pericardial sac

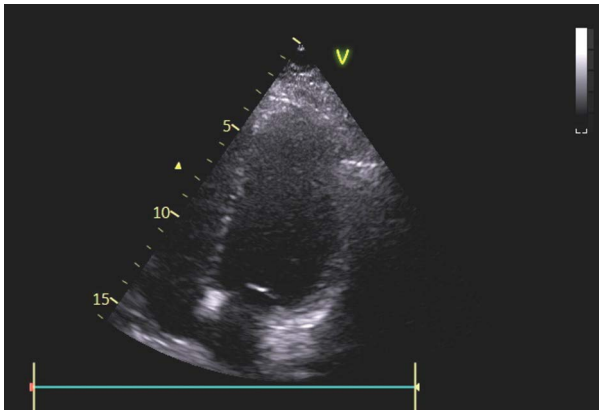

Figure 3. Echocardiography in 4-chambers apical projection. The correct proportion of the size of the left ventricle to the right ventricle is visible. No fluid in the pericardial sac

all coronary arteries, with TIMI (Thrombolysis in Myocardial Infarction) 3 flow to the periphery] [9].

It may be suspected that the patient experienced "myocardial infarction with non-obstructive coronary arteries" (no lesions narrowing the lumen by ≥ 50%) — MINOCA [8]. However, MINOCA is a working diagnosis that requires further investigation to determine the cause of the pathology. Due to the confirmed SARS-CoV-2 infection, a viral etiology of the heart damage was suspected. In our woman retrosternal symptoms appeared approximately 14 days after the first symptoms of COVID-19, thus, ongoing inflammation could have triggered the release of troponins. On the other hand, the markers of inflammation [CRP, procalcitonin, ferritin, interleukin 6 (IL-6), and myoglobin] were normal and the chest X-ray showed no evidence of infiltrative changes in lungs.

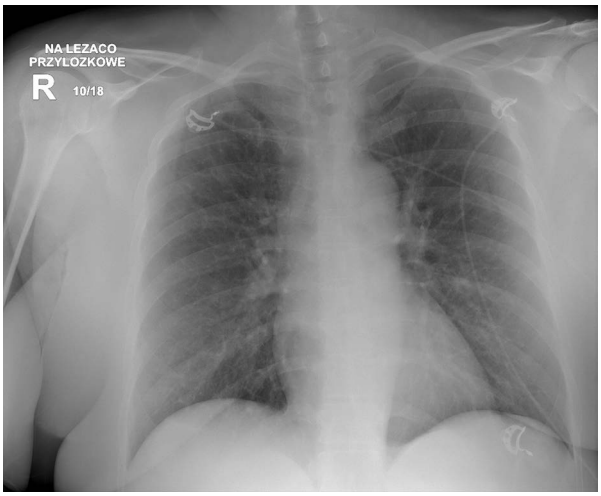

Figure 4. Chest X-ray in antero-posterior view, in the supine position. Pulmonary fields without infiltrative changes. Heart profile within the normal range for the supine position. Free diaphragm. The shadow of medical equipment projecting on the structures of the chest

The systematic review of 14 cases of myocarditis secondary to COVID-19 was published in August 2020 [5]. The authors found that COVID-19 myocarditis was slightly more common in men (58%), around the age of 50, the most common accompanying disease was HTN (33% of respondents), but 50% of cases had no comorbidities. Although ECGs did not show any pathology in some of these cases, troponin levels were elevated in 91% of the subjects. Echocardiography showed a decreased left ventricular EF in 60% of patients. Among 14 documented cases of myocarditis, seven had no CRP test, two had normal CRP levels, and four had slightly elevated CRP values (10–20.7 mg/dL); only one had a very high level of CRP. In this group glucocorticoids were used most frequently in the treatment of myocarditis (58% of cases), but a significant percentage of patients were in a severe general condition [5]. The clinical and biochemical profile of our patient is in many domains similar to the cases included in the above mentioned review. Chronic steroid therapy and non-steroidal anti-inflammatory drugs were not initiated in our patient because of good general condition and no need for oxygen therapy. Moreover, the woman did not have increased CRP levels, had no fever, no fluid in the pericardial sac, and the administered retrosternal complaints subsided after a few days.

It cannot be ruled out that the cause of the chest complaints reported by the patient and the observed increase in troponin levels may have been due to transient thrombotic changes in the coronary artery. It could be caused either by a rupture or ulceration of an atherosclerotic lesion that does not significantly narrow the lumen of the artery, or by a mechanism of peripheral microembolism

(coronary embolism). The physiological mechanisms of fibrinolysis and the treatment used before coronary angiography (ASA and LMWH given to the patient both in the district hospital and in our Department) could dissolve the embolic material and restore normal blood flow (TIMI 3) in all coronary arteries.

In the discussed case, this suggestion may be reinforced by the observation of slightly, but still elevated D-dimer values. It is known that pulmonary, heart, brain and other organ microemboli are significant complications of COVID-19. Moreover, infection with SARS-CoV-2 causes chronic dysfunction or damage to the vascular endothelium [10]. Eventually, the patient was diagnosed with a myocardial injury possibly secondary to a SARS-CoV-2 infection, and therefore would be called as a patient with "COVID-MINOCA" or "MINOCA caused by COVID-19".

Conclusion

Myocarditis secondary to SARS-CoV-2 infection can be a possible cause of ACS during COVID-19 pandemic.

Acknowledgements

None.

Conflict of interest

The authors declare no conflict of interests.

Streszczenie

W grudniu 2019 roku zidentyfikowano nowy wirus — SARS-CoV-2 (*severe acute respiratory syndrome coronavirus 2*), który szybko stał się powodem światowej pandemii. Ze względu na dużą zakaźność wirusa konieczne było opracowanie schematów postępowania z pacjentami z ostrymi problemami kardiologicznymi groźnymi dla zdrowia i życia (np. z zawałami serca, arytmiami), którym współtowarzyszyła infekcja tym patogenem. W pracy przedstawiono opis przypadku pacjentki zakażonej SARS-CoV-2, u której ze względu na zgłaszany ból w klatce piersiowej, podwyższone markery martwicy miokardium oraz obecność czynników ryzyka choroby niedokrwiennej serca rozpoznano ostry zespół wieńcowy (ACS). W wykonanej koronarografii nie uwidoczniono zmian miażdżycowych. W przebiegu infekcji SARS-CoV-2 może także wystąpić zapalenie osierdzia lub mięśnia sercowego o etiologii wirusowej, które może również powodować podobne objawy do ACS.

Słowa kluczowe: COVID-19, zapalenie mięśnia sercowego, ostry zespół wieńcowy, MINOCA, opis przypadku

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