AKADÉMIAI KIADÓ

Pericarditis related to post-acute COVID infection: A case report and review of the literature

Acta Microbiologica et Immunologica Hungarica

70 (2023) 2, 100–110

DOI:
10.1556/030.2023.02055

NHU NGOC NGUYEN[1,2], PIERRE DUDOUET[2], CATHERINE DHIVER[2] and PHILIPPE GAUTRET[1,2]*

[1] Aix Marseille University, IRD, AP-HM, SSA, VITROME, Marseille, France

[2] IHU-Méditerranée Infection, Marseille, France

Received: May 5, 2023 • Accepted: May 23, 2023
Published online: June 2, 2023

RESEARCH ARTICLE

ABSTRACT

Cardiovascular involvement has been described in acute and recovered COVID-19 patients. Here, we present a case of symptomatic pericarditis with persistent symptoms for at least six months after the acute infection and report 66 published cases of pericarditis in discharged COVID patients. Patient mean age ± SD was 49.7 ± 13.3 years, ranging from 15 to 75 years and 57.6% were female. A proportion of 89.4% patients reported at least one comorbidity, with autoimmune and allergic disorders, hypertension and dyslipidaemia, as the most frequent. Only 8.3% of patients experienced severe symptoms of acute COVID-19. The time between acute COVID and pericarditis symptoms varied from 14 to 255 days. Chest pain (90.9%), tachycardia (60.0%) and dyspnoea (38.2%) were the most frequent symptoms in post-acute pericarditis. A proportion of 45.5% and 87% of patients had an abnormal electrocardiogram and abnormal transthoracic ultrasound, respectively. Colchicine combined with non-steroidal anti-inflammatory drug (NSAID) or acetylsalicylic acid (aspirin) were prescribed to 39/54 (72%) patients. Of them, 12 were switched to corticosteroid therapy due to non-response to the first-line treatment. Only 6 patients had persisting symptoms and were considered as non-respondent to therapy.

Our report highlights that pericarditis should be suspected in COVID-19 patients with persistent chest pain and dyspnoea when pulmonary function is normal. Treatment with non-steroidal anti-inflammatory and colchicine is usually effective but corticosteroids are sometimes required.

KEYWORDS

COVID-19, SAR-CoV-2, pericarditis, pericardial effusion, post-acute COVID, long COVID

INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was initially described in China at the end of 2019 and caused a pandemic. As of 3rd of May 2023, 765,222,932 confirmed cases were reported by World Health Organization, including 6,921,614 deaths (2.0% of positive cases) [1]. 'Typical' symptoms of fever, cough and dyspnoea are the most commonly reported symptoms in COVID-19 patients [2]. This virus, however, can damage other organs in the human body, including notably the heart. In one cohort study conducted on 416 hospitalised COVID-19 patients, 19.7% presented a cardiac injury [3]. Long-term persistent COVID-19 symptoms have been reported in the literature, including notably fatigue, headache, attention disorders, hair loss, and dyspnoea [4]. However, cardiac symptoms persistence associated with pericarditis is rarely reported. One cohort study conducted in united state showed that COVID-19 infection was identified as a risk factor for long-term myocarditis and pericarditis [5]. In another study conducted among more than 4 million individuals in the US, COVID-19 survivors had a higher risk for pericarditis as compared non-COVID-19 individuals (HR = 1.621 [1.452–1.810]) [6]. In this report, we describe a

*Corresponding author. VITROME, Institut Hospitalo-Universitaire Méditerranée Infection, 19–21 Boulevard Jean Moulin 13385, Marseille Cedex 05, France.
Tel.: +33 (0) 4 13 73 24 01;
fax: +33 (0) 4 13 73 24 02.
E-mail: philippe.gautret@ap-hm.fr

patient with persistent pericarditis following COVID-19 and review the available relevant literature.

CASE PRESENTATION

A 54-year-old female, professional singer with a past history of Hashimoto's thyroiditis in 2008, was admitted to our institute for long-term dyspnoea and chest tightness upon exertion in June 2021. Her medical history revealed COVID-19 infection symptoms in March 2021, with fever and loss of smell and taste. Two SARS-CoV-2 PCR tests and one antigen test were all negative. She received oral treatment with ivermectin and azithromycin (off label, since these medicines are not approved for the treatment of COVID-19), and her fever rapidly disappeared. Fifteen days later, she suffered anterior constrictive thoracic pain that increased on deep inspiration and lying position, and exertional dyspnoea, notably when singing. Physical examination was normal. A diagnostic of pericarditis was established by a cardiologist based on the clinical symptoms, without abnormal observation on trans-thoracic echography and electrocardiogram (ECG). With the exception of troponin which level was normal, other cardiac biomarkers were not checked. A computed tomography (CT) scan was performed in May 2021 which confirmed the pericarditis with a dependant pericardial effusion and showed the absence of residual pulmonary parenchymal lesion (Fig. 1). A second ECG performed in June 2021 was normal. She was first treated with aspirin 2 g day^{-1} for two weeks. The treatment was stopped due to an episode of anxiety, hallucination and confusion. These symptoms resolved after aspirin was stopped. Then, she was treated with colchicine 1 mg $days^{-1}$ for six weeks.

On the 23rd of June 2021 she once again presented at our infectious diseases institute due to the persistence of cardiac symptoms. She also reported persistent dysnosmia and dysgeusia. A whole-body position emission tomography scan (PET scan) showed moderate hypermetabolism of the thyroid and sigmoid colon. The ECG was normal. Her thyroid hormone dosage was normal, but high anti-thyroid peroxidase antibody (>2000 UI mL^{-1}) and high anti-thyroglobulin antibody (99 UI mL^{-1}) levels were observed. No further immunological tests were performed. Neutropenia at 1,100 mm^{-3}, C reactive protein at 0.7 mg L^{-1} and moderate hepatic cytolysis (ALT 41 UI/L and CPK 50 UI/L) were observed. Erythrocyte sedimentation rate was normal. SARS-CoV-2 antibodies were checked on the 10th of September 2021 and positive at 274 units ml^{-1}. She was not vaccinated against COVID-19 at any time. In addition, a pulmonary function test conducted in October 2021 revealed no abnormalities, although she continued to complain of exertional dyspnoea and chest tightness. As of May 2023, chest pain disappeared while the exertional dyspnoea persisted. The patient did not perform CT scan and trans-thoracic echography controls at follow-up.

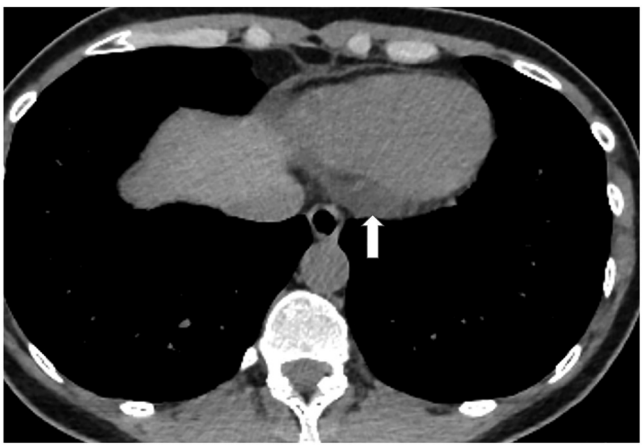

Fig. 1. Low dose CT scan in axial view showing a dependent pericardial effusion (arrow)

REVIEW OF THE LITERATURE

We performed a literature search based on Medline Embase and Google scholar databases for articles published before the 20th of May 2023, by combining keywords ("SARS-CoV-2" OR "COVID-19") AND ("pericarditis" OR "pericardial effusion") AND ("sequelae" OR "persistence" OR "persistent" OR "long-COVID" OR "long-haul COVID" OR "post-acute COVID syndrome" OR "persistent COVID-19" OR "long-hauler COVID" OR "post-acute sequelae" of "SARS-CoV-2 infection" OR "chronic COVID syndrome"). These keywords were identified by using the synonym and MeSH terms to provide a general understanding of the literature. We made a distinction between: (1) post-acute COVID (symptoms and abnormalities presenting from four to twelve weeks after the onset of symptoms) and (2) long COVID (symptoms and anomalies persisting more than twelve weeks after the onset) [7, 8]. We identified 12 studies, including nine relevant case reports [9–17] one case series of seven patients [18], and two retrospective cohort studies [19, 20] with respectively 11 and 39 cases (Table 1). Post-acute and long COVID pericarditis or myopericarditis were observed in 12 and 54 patients, respectively. The age of patients ranged from 15 to 75 years old and the mean age ± SD was 49.7 ± 13.3 years. A proportion of 38/66 (57.6%) patients were female [9–20]. Most cases were from Italy (n = 49) [18, 20] followed by Israel (n = 11) [19] and the US (n = 7) [9–13, 16, 17]. Most patients (n = 59, 89.4%) presented at least one comorbidity with autoimmune and allergic disorders (n = 15), hypertension (n = 13), dyslipidaemia (n = 10) and obesity (n = 7) the most frequent. Information about the severity of the disease at the acute phase was available for 24 patients of whom 2 (8.3%) experienced severe COVID-19 symptoms [10, 18], while others had mild to moderate symptoms [9, 11–15, 18]. The mean time ± SD between acute COVID-19 and post-acute [9–11, 13, 15, 17, 18] or long COVID [12, 14–16, 18] pericarditis was available for 16 patients and was 40.8 ± 19.2

Table 1. Characteristics of 66 COVID-19 patients with post-acute/long COVID pericarditis or myopericarditis published in the medical literature

Reference	Country	Number of patients	Definition case	Age (years), sex	Comorbiditys	Acute COVID severity, symptoms and SARS-CoV-2 infection confirmation	Time between acute COVID and cardiac symptoms	Persistent clinical symptoms	Imaging, ECG and laboratory findings	Final diagnosis	Cardiac treatment	Outcome	Remark
Fox K et al. 2020 [9]	USA	1	Post-acute COVID	43, Male	No	Moderate (fever, orthopnea, conversational dyspnea, chest pain radiating to the neck and left shoulder), confirmed by PCR	Two weeks	Chest pain	Transthoracic US: moderate circumferential pericardial Chest X-ray: cardiomegaly with the absence of pulmonary infiltrates ECG: sinus tachycardia with low voltage as well as diffuse concave ST-elevation and PR segment depression, PR elevation in aVR Troponin: normal CPK: normal D-Dimer: X1.3N LDH: X2.5N	Pericarditis	Colchicine, ibuprofen and removing of 400 mL of serosanguinous fluid	Good without sequelae at one month of follow-up	
Riverra-Morales MD.2020 [10]	USA	1	Post-acute COVID	73, Male	Hypertension, dyslipidemia, diabetes mellitus type 2 and former nicotine dependence	Severe (pneumonia, hospitalized)	6–8 weeks	Chest pain, dyspnea	Transthoracic US: a small pericardial effusion grade I diastolic dysfunction, with ejection fraction of 40%–50% and increased wall thickness, concentric hypertrophy Coronary angiography: non obstructive coronary artery disease Chest X-ray: negative for acute cardiopulmonary process ECG: sinus rhythm, concave shaped STE different magnitudes in leads I, II, II, aVF, v2 to v6 Troponin I: normal	Myopericarditis	Not described	Not described	

(continued)

Table 1. Continued

Reference	Country	Number of patients	Definition case	Age (years), sex	Comorbiditys	Acute COVID severity, symptoms and SARS-CoV-2 infection confirmation	Time between acute COVID and cardiac symptoms	Persistent clinical symptoms	Imaging, ECG and laboratory findings	Final diagnosis	Cardiac treatment	Outcome	Remark
Foster B et al. 2021 [11]	USA	1	Post-acute COVID	44, Female	Factor V Leiden deficiency	Mild (asymptomatic), confirmed by PCR	21 days	Chest pain	Transthoracic US: large pericardial effusion with right ventricular diastolic invagination consistent with tamponnade MRI: acute hemorrhagic pericardial effusion with probable pericardial tamponnade Chest tomography: no effusion Chest X-ray: normal ECG: PR interval in leads II, III, aVF and mild elevation of the PR interval in aVR. Troponin: X13.3N D-Dimer: X1.2N LDH: 2.4N	Pericarditis	Colchicine	Improvement of symptoms after 24 h no sequelae	
Solie Z W et al. 2021 [12]	USA	1	Long COVID	29, Female	No	Mild (myalgia, fatigue, headache), confirmed by PCR	25 days	Chest pain, dyspnea	Transthoracic US pericardial effusion Chest tomography: large circumferential pericardial effusion ECG: sinus tachycardia Troponin levels: normal	Pericarditis	Aspirin, prednisolone, colchicine	Good without sequalae at three months of follow-up	
Kaminski A et al. 2021 [13]	USA	1	Post-acute COVID	65, Male	Hypertension, obstructive apnea syndrome, atrial fibrillation	Mild (left-sided neck and shoulder pain, abdominal pain, fever, cough, myalgia), confirmed by PCR	72 days	Chest pain, fever	Transthoracic US: posterior pericardial effusion Chest tomography: pericardial effusion, pericardial thickening, and left pleural effusion Chest x-ray: small left pleural effusion ECG: PR depression and diffusion St elevation Troponin: X1.1N ng L^{-1} D-Dimer: 6.178 ng mL^{-1}	Pericarditis	NSAIDS, remdesivir	Good without sequelae at six weeks of follow-up.	

(continued)

Table 1. Continued

Reference	Country	Number of patients	Definition case	Age (years), sex	Comorbiditys	Acute COVID severity, symptoms and SARS-CoV-2 infection confirmation	Time between acute COVID and cardiac symptoms	Persistent clinical symptoms	Imaging, ECG and laboratory findings	Final diagnosis	Cardiac treatment	Outcome	Remark
Vera-Lastra O et al. 2021[14]	Mexico	1	Long COVID	31, Male	No	Mild (fever, myalgia, arthralgia), confirmed by PCR	15 days	Chest pain, dyspnea, tachycardia, myalgia, arthralgia, fatigue	Transthoracic US: pericarditis, LVEF: 43% Chest tomography: patchy glass pulmonary opacities MRI: inferoseptal hyperkinesia, mild global myocardial hyperintensity, LVEF: 40% Cardiac scintigraphy: myocardial hyperinflammation ECG: normal Troponin: X1.8N CPK: X2.7N CPK-MB: X5N LDH: X4.3N ASAT: X8.2N	Myopericarditis	NSAIDS, colchicine, prednisolone	Good without sequelae at one year of follow-up	
Lambrino N et al. 2021 [15]	Greece	1	Post-acute COVID	15, Male	Corneal transplantation	Mild (fever), confirmed by PCR	20 days	Chest pain, tachycardia	Transthoracic US: a small pericardial effusion all over the heart, size <1 cm in front of the posterior wall of the left ventricle, normal cardiac function Chest tomography: not done ECG: depression of the QT segment and an elevation of ST segment in the leads I, V2–V6 Troponin: normal CPK: normal D-Dimer: X3.8N LDH: normal	Pericarditis	NSAIDs, colchicine	Good, reduction of the pericardial effusion in four days	
Khanavis et al. 2022 [16]	USA	1	Long COVID	43, Male	No	Mild (chest pain, shortness of breath, cough due to pain)	4 months	Chest pain, dyspnea, tachycardia	Chest CT: a small pericardial effusion Chest X ray: small left pleural effusion and a trace right pleural effusion ECG: sinus tachycardia and widespread ST depression D-dimer: X14N	Pericarditis	NSAIDs, colchicine	Not described	

(continued)

Table 1. Continued

Reference	Country	Number of patients	Definition case	Age (years), sex	Comorbiditys	Acute COVID severity, symptoms and SARS-CoV-2 infection confirmation	Time between acute COVID and cardiac symptoms	Persistent clinical symptoms	Imaging, ECG and laboratory findings	Final diagnosis	Cardiac treatment	Outcome	Remark
Actif Masood Noori M et al. 2021 [17]	USA	1	Post-acute COVID	44, Male	No	Not described (COVID-19 pneumonia)	1 month	Dry cough	Chest radiograph: normal Transthoracic echocardiogram: left ventricular ejection fraction (LEVF): 40–50%, mildly decreased globular left ventricular systolic function and moderate to severe hypokinesis involving inferior wall Cardiac MRI: mild to moderate reduced LVEF (38%), moderate hypokinesis of midventricular inferolateral wall, edema/inflammation of epicardium and epicardial of basal anteroseptal and anterior wall and midventricular anterolateral, inferolateral and inferior wall ECG: concave-shaped ST elevation in inferior and lateral leads Troponin: X3.9N D-dimer: X1.1N	Myopericarditis	Aspirin, clopidogrel and colchicine	Good without sequalae at 2-weeks of follow-up	
Carubbi F et al. 2021 [18]	Italy	7 1st	Post-acute COVID	75, Male	Hypertension, osteoarthritis	6 patients with mild-moderate symptoms and one patient with severe symptoms, all confirmed by PCR	25 days	Chest pain reported in all patients, dyspnea, palpitation and fever in four patients and arthralgia in one patient	Transthoracic US: normal ECG: abnormalities in three patients (2 with PR depression and 1 with ST elevation) Troponin: mildly elevated in patients with St elevation and one of PR depression	Pericarditis	NSAID, colchicine (1st line therapy, no response), prednisolone (2nd Line therapy)	Good without sequelae at 9 weeks of follow-up	
		2nd		73, Female	Hypertension, osteoarthritis, osteoporosis, hypothyroidism		32 days			Pericarditis	Aspirin, colchicine (1st line therapy, no response), prednisolone (2nd line therapy)	Good without sequelae at 10 weeks of follow-up	

(continued)

Table 1. Continued

Reference	Country	Number of patients	Definition case	Age (years), sex	Comorbiditys	Acute COVID severity, symptoms and SARS-CoV-2 infection confirmation	Time between acute COVID and cardiac symptoms	Persistent clinical symptoms	Imaging, ECG and laboratory findings	Final diagnosis	Cardiac treatment	Outcome	Remark
		3rd		52, Male	Obesity		50 days			Pericarditis	NSAID, colchicine	Good without sequelae at 5 weeks of follow-up	
		4th		69, Male	Hypertension, atrial fibrillation, osteoarthritis, dyslipidemia		45 days			Pericarditis	NSAID, colchicine (1st, no response), Prednisolone (2nd line therapy)	Good without sequelae at 10 weeks of follow-up	
		5th		42, Female	No		31 days			Pericarditis	Aspirin, colchicine (response)	Good without sequelae at 7 weeks of follow-up	
		6th		45, Female	No		42 days			Pericarditis	NSAID, colchicine (response)	Good without sequelae at 5 weeks of follow-up	
		7th	Long COVID	61, Female	Hypertension, dyslipidemia, depression		54 days			Pericarditis	Aspirin, colchicine (1st line therapy, no response), prednisolone (2nd line therapy)	Good without sequelae at 14 weeks of follow-up	
Tuvali O. 2022 [19]	Israel	11	Long COVID	F/M: 3/8 Age: Mean ± SD: 45.6 ± 19.3	Obesity (n = 6, 54.5%), hyperlipidemia (n = 4, 36.4%), hypertension (n = 3, 27.3%), smoking (n = 2, 18.2%), acute coronary syndrome (n = 2, 18.2%), cerebrovascular accident (n = 2, 18.2%), heart failure (n = 1, 9.1%), diabetes (n = 1, 9.1%), chronic kidney disease (n = 1, 9.1%)	All confirmed by PCR	Not described	Not described	Not described	Pericarditis	Not described	Not described	Prevalence of pericarditis was 11/196,992 (0.006%) unvaccinated COVID-19 patients. Male gender and peripheral vascular disease were associated with pericarditis

(continued)

Table 1. Continued

Reference	Country	Number of patients	Definition case	Age (years), sex	Comorbidityes	Acute COVID severity, symptoms and SARS-CoV-2 infection confirmation	Time between acute COVID and cardiac symptoms	Persistent clinical symptoms	Imaging, ECG and laboratory findings	Final diagnosis	Cardiac treatment	Outcome	Remark
Dini F.L. 2023 [20]	Italy	39	Long COVID	F/M: 31/8 Age (years): Mean ± SD: 45 ± 14	Autoimmune and allergic disorders (n = 15, 38%), asthma/chronic obstructive pulmonary disease (n = 3, 7%), hypertension (n = 4, 10%), dyslipidemia (n = 3.7%), diabetes (n = 1, 3%), coronary artery disease (n = 1, 3%),	Mostly ambulatory patients, all confirmed by PCR	Median: 166 days, range: 116–255 days	Chest pain/ discomfort (n = 35, 90%), heart palpitations/ arrhythmias (n = 26, 67%), shortness of breath/fatigue (n = 13, 33%, fever (n = 8, 21%), brain fog/lack of concentration (n = 5, 13%), cough (n = 4, 10%), headache (n = 1, 3%)	Transthoracic US: mild-to-moderate pericardial effusion (n = 12, 31%), pericardial layers were thickened and bright with a small or negligible effusion (n = 27, 69%) ECG: abnormalities with concave ST segment elation in most leads/focal T wave inversion in several leads, n = 15, 39%) Abnormal C reactive protein: n = 8, 21% Abnormal erythrocyte sedimentation rate: (n = 10, 26%) Abnormal D dimer: n = 4, 10% Troponin: normal	Pericarditis	Initial treatment: NSAID (n = 25, 64%), colchicine (n = 26, 67%), corticosteroid (n = 8, 1%). Switched to corticosteroid due to non-responded to NSAID (n = 7, 18%)	Good without sequelae (n = 33, 85%) and non-responded to therapy (n = 6, 15%)	Prevalence of pericarditis was 39/180 (22%) patients with long COVID. Female gender, prior COVID-19 vaccination, history of autoimmune and allergic disorders were associated with pericarditis

Abbreviation: AST = Aspartate aminotransferase; CPK = Creatine phosphokinase; CRP = C-reactive protein; ECG = Electrocardiogram; LDH = Lactic de-hydrogenase; LVEF = Left ventricular ejection fraction; MRI = Magnetic resonance imaging; NSAID = Non-steroidal anti-inflammatory drug; PCR = Polymerase chain reaction; Transthoracic US = Transthoracic ultrasound.

days, ranging from 14 to 120 days [9–18]. The median time was 166 days, ranging from 116 to 255 days as reported for 39 patients in one study [20]. A total of 55 patients had available information on clinical post-acute symptoms with chest pain (n = 50, 90.9%), tachycardia (n = 33, 60.0%) and dyspnoea (n = 21, 38.2%) the most common persisting symptoms (Table 2) [9–18, 20]. Abnormal electrocardiogram (ECG) was reported in 25/55 (45.5%) patients [9–18, 20] abnormal transthoracic ultrasound in 47/54 (87%) patients [9–15, 17, 18, 20], and elevated troponin in 6/54 (10.9%) patients [9–15, 17, 18, 20]. Magnetic resonance imaging (MRI) was performed in three patients and was abnormal in all cases [11, 14, 17] (Table 1). Among 54 patients with information on therapy, 39 (72%) were treated with colchicine combined with non-steroidal anti-inflammatory drug (NSAID) or acetylsalicylic acid (aspirin) [9, 12, 14–18, 20], 21 with corticoid therapy [12, 14, 18, 20], and one was treated only with colchicine only [11] because of a contraindication to NSAID and aspirin (Table 1). Corticosteroid therapy was prescribed as an adjunct treatment for 12 patients (22.2%) following non-responses to colchicine combined with non-steroidal anti-inflammatory drug (NSAID) or acetylsalicylic acid (aspirin) treatment [14, 18, 20]. The follow-up duration varied from 2 weeks to less about one year after the acute phase, results observed from six studies with available information [9, 12–14, 17, 18]. A proportion of 47/53 (88.7%) patients had good outcomes without sequelae [9, 11–15, 17, 18] while 6 patients (11.3%) had persistence of symptoms and were considered as non-respondent to therapy [20]. None of these patients died. In one study, peripheral vascular disease [19], the presence of chest pain, history of autoimmune and allergic disorders, palpitation or arrhythmias were associated [20] with the development of pericarditis. Contradictory result on the effect of gender were observed in two studies, one with higher risk for pericarditis in male [19] and another in female patients [20].

Table 2. Symptoms in fifty-four COVID-19 patients with pericarditis or myopericarditis in discharged COVID-19 patients

Symptoms	n (%)
Chest pain	50 (90.9)
Palpitation	33 (60.0)
Dyspnea	21 (38.2)
Fever	13 (23.6)
Dyspnea/fatigue[1]	13 (23.6)
Dysfunction concentration	5 (9.1)
Cough	4 (7.3)
Arthralgia	2 (3.6)
Fatigue	1 (1.8)
Myalgia	1 (1.8)
Headache	1 (1.8)

[1]One study reported dyspnea and fatigue in combination.

DISCUSSION

The aetiology of pericarditis can be divided into two categories, including non-infectious and infectious diseases. Tuberculosis is responsible for 70% of cases of pericarditis diagnosed in developing countries, while it accounts for less than 5% in developed countries. In western Europe and North America, 80–90% of pericarditis cases are diagnosed as idiopathic and mostly due to viral infections, including with enteroviruses, herpesviruses and adenoviruses [21, 22]. Although the most frequent clinical presentation of SARS-CoV-2 infection is acute respiratory failure, extra-pulmonary forms, including myocardial-pericardial injury, are not uncommon [23, 24]. The prevalence of pericarditis was less than 0.1% in recovered COVID-19 patients in one study [19]. In another study [20] conducted in patients with long COVID a 21.7% pericarditis rate was observed. A recent systematic literature review including studies on adult patients undergoing cardiac assessment after COVID-19 recovery reported a prevalence of pericardial effusion in 12.6% patients on cardiac magnetic resonance [25]. Small pericardial effusion may be relatively common in the post-acute period of COVID-19, but overt pericarditis, especially with symptoms, seems a rarer occurrence [25]. In this report, we describe 66 pericarditis and myopericarditis in discharged COVID-19 patients. Most patients had good response to treatment with colchicine combined with NSAID or aspirin or corticosteroid therapy. Majority of patients had the good outcomes without sequalae at follow-up time. A limitation of our case report is the missing laboratory-confirmed SARS-CoV-2 infection at the acute phase. Nevertheless, the positive serology allows retrospective confirmation of the COVID-19 diagnosis in the absence of vaccination. Another limitation is the lack of other viral investigations for the aetiology of pericarditis. Finally, we cannot exclude that this pericarditis was the result of a new-onset autoimmune disease possibly triggered by the recent viral infection in the context of Hashimoto thyroiditis [26, 27].

CONCLUSIONS

Although rarely reported, the long-term persistence of pericarditis sequelae may occur in COVID-19 patients and cardiac investigation should be conducted in patients with persistent dyspnoea and thoracic pain following SARS-CoV-2 infection. The detailed immune mechanisms linked to pericarditis after SARS-CoV-2 infection recovery remains unknown. It could be that the inflammatory process is the origin of this cardiac presentation. It is possible that an insufficient or delayed humoral response may decrease the virus clearance locally at the peri-myocardium, and that local persistence of viral material would trigger a local inflammatory response accounting for pericardial symptoms. However, only one study reported the presence of SARS-CoV-2 material by PCR in pericardial effusion fluid in one patient [28].

Funding: No funding.

Conflicts of interest: The authors declare that they have no conflict of interest.

Availability of data and material: Data sharing not applicable to this article as no dataset were generated or analysed during the current study.

Code availability: Not applicable.

Ethical approval: Written consent was obtained from the patient.

Author contribution: All authors contributed equally to the writing and revision of the paper.

Consent to participate: The patient has consented to the submission of the case report for submission to the journal.

Consent to publish: Patient signed informed consent regarding publishing her data and photographs.

ACKNOWLEDGEMENTS

We thank Professor Alexis Jaquier for his help in interpreting CT scan images.

REFERENCES

1. World Health Organization. WHO Coronavirus (COVID-19) dashboard; 2021. Available online: https://covid19.who.int/ [Accessed 3 May 2023].
2. ISARIC Clinical Characterisation Group. COVID-19 symptoms at hospital admission vary with age and sex: ISARIC multinational study. Preprint Medrxiv 2020; 2020.10.26.20219519. Published 2020 Nov 19. https://doi.org/10.1101/2020.10.26.20219519.
3. Shi S, Qin M, Shen B, Cai Y, Liu T, Yang F et al. Association of cardiac injury with mortality in hospitalized patients with COVID-19 in Wuhan, China. JAMA Cardiol 2020; 5(7): 802–10. https://doi.org/10.1001/jamacardio.2020.0950.
4. Lopez-Leon S, Wegman-Ostrosky T, Perelman C, Sepulveda R, Rebolledo PA, Cuapio A, et al. More than 50 Long-term effects of COVID-19: a systematic review and meta-analysis. Preprint Medrxiv 2021; 2021.01.27.21250617. Published 2021 Jan 30. https://doi.org/10.1101/2021.01.27.21250617.
5. Xie Y, Xu E, Bowe B, Al-Aly Z. Long-term cardiovascular outcomes of COVID-19. Nat Med 2022; 28(3): 583–90. https://doi.org/10.1038/s41591-022-01689-3.
6. Wang W, Wang CY, Wang SI, Wei JC. Long-term cardiovascular outcomes in COVID-19 survivors among non-vaccinated population: a retrospective cohort study from the TriNetX US collaborative networks [published correction appears in EClinicalMedicine. 2023 May;59:101968]. EClinicalMedicine 2022; 53: 101619. https://doi.org/10.1016/j.eclinm.2022.101619.
7. Nalbandian A, Sehgal K, Gupta A, et al. Post-acute COVID-19 syndrome. Nat Med 2021; 27(4): 601–15. https://doi.org/10.1038/s41591-021-01283-z.
8. Yong SJ. Long COVID or post-COVID-19 syndrome: putative pathophysiology, risk factors, and treatments. Infect Dis (Lond) 2021; 53(10): 737–54. https://doi.org/10.1080/23744235.2021.1924397.
9. Fox K, Prokup JA, Butson K, Jordan K. Acute effusive pericarditis: a late complication of COVID-19. Cureus 2020; 12(7): e9074. Published 2020 Jul 8. https://doi.org/10.7759/cureus.9074.
10. Rivera-Morales MD, Pell R, Rubero J, Ganti L. Acute myopericarditis in the post COVID-19 recovery phase. Cureus 2020; 12(10): e11247. Published 2020 Oct 29. https://doi.org/10.7759/cureus.11247.
11. Foster B, Liaqat A, Chib A, Bolton SS, Kendig AC. An unusual presentation of COVID-19: hemorrhagic pericardial effusion with tamponade physiology. Cureus 2021; 13(2): e13438. Published 2021 Feb 19. https://doi.org/10.7759/cureus.13438.
12. Sollie ZW, Vallepu SR, Tharumia Jagadeesan C, White LC, Nagalapuram V. Challenges in managing pericardial disease related to post viral syndrome after COVID-19 infection. Cureus 2021; 13(2): e13461. Published 2021 Feb 20. https://doi.org/10.7759/cureus.13461.
13. Kaminski A, Albus M, Mohseni M, Mirzan H, Harrison MF. A delayed case of pericarditis following recovery from COVID-19 infection. Cureus 2021; 13(4): e14397. Published 2021 Apr 10. https://doi.org/10.7759/cureus.14397.
14. Vera-Lastra O, Lucas-Hernández A, Ruiz-Montiel JE, Gonzalez-Rodriguez VR, Pineda-Galindo LF. Myopericarditis as a manifestation of long COVID syndrome. Cureus 2021; 13(11): e19449. Published 2021 Nov 10. https://doi.org/10.7759/cureus.19449.
15. Lamprinos N, Ladomenou F, Stefanaki S, Foukarakis E, Vlachaki G. Pericarditis following recovery from COVID-19 infection in a 15-year-old boy: a postinflammatory immune-mediated presentation or a new-onset autoimmune disease. Cureus 2021; 13(11): e19255. Published 2021 Nov 4. https://doi.org/10.7759/cureus.19255.
16. Khasnavis S, Habib M, Kaawar F, Lee S, Capo A, Atoot A. New perspectives on long COVID syndrome: the development of unusually delayed and recurring pericarditis after a primary SARS-CoV-2 infection. Cureus 2022; 14(6): e25559. Published 2022 Jun 1. https://doi.org/10.7759/cureus.25559.
17. Atif Masood Noori M, Rushdy A, Fichadiya H, et al. Stemi mimicking post COVID: a case of focal myopericarditis post COVID infection. J Community Hosp Intern Med Perspect 2021; 11(6): 769–71. Published 2021 Nov 15. https://doi.org/10.1080/20009666.2021.1980964.
18. Carubbi F, Alunno A, Leone S, et al. Pericarditis after SARS-CoV-2 infection: another pebble in the mosaic of long COVID? Viruses 2021; 13(10): 1997. Published 2021 Oct 4. https://doi.org/10.3390/v13101997.
19. Tuvali O, Tshori S, Derazne E, et al. The incidence of myocarditis and pericarditis in post COVID-19 unvaccinated patients-A large population-based study. J Clin Med 2022; 11(8): 2219. Published 2022 Apr 15. https://doi.org/10.3390/jcm11082219.
20. Dini FL, Baldini U, Bytyçi I, Pugliese NR, Bajraktari G, Henein MY. Acute pericarditis as a major clinical manifestation of long COVID-19 syndrome. Int J Cardiol 2023; 374: 129–34. https://doi.org/10.1016/j.ijcard.2022.12.019.

21. Imazio M, Gaita F, LeWinter M. Evaluation and treatment of pericarditis: a systematic review [published correction appears in JAMA 2015 Nov 10;314(18):1978] [published correction appears in JAMA. 2016 Jan 5;315(1):90. Dosage error in article text]. JAMA 2015; 314(14): 1498–506. https://doi.org/10.1001/jama.2015.12763.
22. LeWinter MM. Clinical practice. Acute pericarditis. N Engl J Med 2014; 371(25): 2410–6. https://doi.org/10.1056/NEJMcp1404070.
23. Madjid M, Safavi-Naeini P, Solomon SD, Vardeny O. Potential effects of coronaviruses on the cardiovascular system: a review. JAMA Cardiol 2020; 5(7): 831–40. https://doi.org/10.1001/jamacardio.2020.1286.
24. Su YB, Kuo MJ, Lin TY, et al. Cardiovascular manifestation and treatment in COVID-19. J Chin Med Assoc 2020; 83(8): 704–9. https://doi.org/10.1097/JCMA.0000000000000352.
25. Ramadan MS, Bertolino L, Zampino R, Durante-mangoni E; monaldi hospital cardiovascular infection study group. Cardiac sequelae after coronavirus disease 2019 recovery: a systematic review. Clin Microbiol Infect 2021; 27(9): 1250–61. https://doi.org/10.1016/j.cmi.2021.06.015.
26. Lorin De La Grandmaison G, Izembart M, Fornes P, Paraire F. Myocarditis associated with Hashimoto's disease: a case report. Int J Leg Med 2003; 117(6): 361–4. https://doi.org/10.1007/s00414-003-0392-5.
27. L Leonardi A, Penta L, Cofini M, Lanciotti L, Principi N, Esposito S. Pericardial effusion as a presenting symptom of Hashimoto thyroiditis: a case report. Int J Environ Res Public Health 2017; 14(12): 1576. Published 2017 Dec 14. https://doi.org/10.3390/ijerph14121576.
28. Farina A, Uccello G, Spreafico M, Bassanelli G, Savonitto S. SARS-CoV-2 detection in the pericardial fluid of a patient with cardiac tamponade. Eur J Intern Med 2020; 76: 100–1. https://doi.org/10.1016/j.ejim.2020.04.045.