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Contents lists available at ScienceDirect

Heart & Lung

journal homepage: www.heartandlung.com

COVID-19 Suspected myopericarditis without pulmonary involvement

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ARTICLE INFO

Article History:

Received 18 June 2021

Revised 29 September 2021

Accepted 2 October 2021

Available online 9 October 2021

Keywords:

Pericardial effusion

Myocarditis

COVID-19

Coronavirus

Coronavirus infections

Severe acute respiratory syndrome coronavirus 2

Pericardiocentesis

Patient discharge

Acute coronary syndrome

Myocytes

Cardiac

ABSTRACT

Myopericarditis is a rare consequence of COVID-19 infection. Although extremely rare, COVID-19 can present without pulmonary involvement, and there have been reports of isolated cardiac involvement in one prior case

We report a case of a young African American man presenting with myopericarditis following a recently recovered COVID-19 infection. Complicated by ICU admission requiring vasopressors; with eventual resolution following initiation of aspirin and colchicine for myopericarditis.

Life threatening myopericarditis can occur following resolution of COVID-19 disease. The degree of cardiac involvement correlates poorly to the severity of pulmonary involvement.

Published by Elsevier Inc.

Introduction

The term myopericarditis indicates a primarily pericardiac syndrome with minor myocardial involvement.¹ Myocarditis is a rare consequence of COVID-19 infection. Large multi-center based studies have found the incidence to be 1% or less.⁵ Despite increased reports of myocardial injury related to COVID-19; the exact pathophysiologic mechanisms remain unclear.⁹ Although extremely rare, COVID-19 can present without pulmonary involvement, and there have been rare reports of isolated cardiac involvement.^{7,8} These prior cases however; either did not require ICU admission, or had a more typical presentation of COVID-19 such as headache,odynophagia, and nasal congestion. We present a rare case of a critically-ill, clinically suspected COVID-19 induced myopericarditis without pulmonary involvement.

Case

A 32-year-old African American male with no medical history presented to the emergency room with chief complaints of shortness of breath, fatigue and non-bloody watery diarrhea for 9 days. He denied abdominal pain, nausea, vomiting, fever and sick contacts. On the first day of presentation upon evaluation in the emergency room; the patient was found to be tachycardic, hypotensive, and afebrile. (Temperature 97.7F, blood pressure 76/40 mmHg, heart rate 50 bpm, pulse oximetry 96% on room air, and respiratory rate of 20 bpm). Physical exam was remarkable for a lethargic appearing young male, with signs of dehydration and increased skin turgor but soft, non-tender, non-distended abdomen. Blood-work was significant for leukocytosis (25 K/mm³) with neutrophilia, thrombocytopenia (144 k/mm³), hyponatremia (128 mmol/L), hypokalemia (3.1 mmol/L), hypochloremia (94 mmol/L), blood urea (70 mg/dL), transaminitis (ALT 170 U/L, AST 121 U/L), elevated CRP (24.6 mg/dL), and lactic acidosis (3.3 mmol/L). A complete respiratory viral panel was negative including SARS-CoV-2 PCR. However, COVID-19 IgG antibody was found to be positive. Admission troponins were elevated (hs-Trop I 553 ng/L which peaked to 2898 ng/L approximately 10 hrs after admission). EKGs during the same time were significant for sinus tachycardia

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with 2 mm convex upwards ST elevations in precordial leads V2, V3, V4. NT-proBNP elevation of (1566 pg/mL) noted. He was given ASA 325 mg, ticagrelor 180 mg, and heparin drip for suspected acute coronary syndrome. Initial echocardiography performed in the emergency room showed Ejection Fraction of 55–60% without wall motion abnormalities.

Shortly after presentation the patient required initiation of a norepinephrine drip to maintain his blood pressure; as he became refractory to volume resuscitation at a goal of 30 cc/kg/hr. He was given one-time doses of broad-spectrum antibiotics in the ED (piperacillin-tazobactam 4.5 gm, and vancomycin 1 gm). CT thorax was performed to evaluate for pulmonary embolism and was negative for filling defects and pulmonary infiltrates. He was then moved to the medical ICU and continued on pressors; however, his antibiotic regimen was changed to optimize enteric coverage with metronidazole, ceftriaxone, and ciprofloxacin. Cardiology was consulted who suspected myopericarditis and recommended starting colchicine 0.6 mg every 12 h and aspirin 650 mg every 8 h. Heparin drip and ticagrelor were discontinued. Extensive workup was unremarkable for any infection except for evidence of recently recovered COVID-19 infection from serum antibody testing and retrospective history Figs. 1 and 2.

On day 2 of admission pressors were continued and a repeat echocardiogram showed a decline in ejection fraction to 50% with interval development of a small pericardial effusion. CT abdomen showed circumferential colonic wall thickening of ascending and descending colon with mild pericolic fat stranding. Clinical course was complicated by occasional episodes of SVT, and persistent IVC collapsibility, as patient continued to have diarrhea for several days after admission. Due to his tachycardia; norepinephrine was stopped and phenylephrine was started. On day 3 of admission vasopressin drip and hydrocortisone 50 mg IVP every 8 h was started in an attempt to wean off pressor support. On day 4 as hemodynamics improved the patient no longer required pressor support and both vasopressin and phenylephrine were discontinued. Subsequent EKGs showed resolution of ST elevations. On the 5th day of admission, blood and urine cultures, urine toxicology obtained on admission returned negative. Stool studies were negative for elevated leukocytes, bacterial culture, Shiga toxin, clostridium difficile antigen and toxin, ova and parasites. EBV, CMV, HIV, hepatitis viral panel, anti-smooth muscle antibody,



Fig. 2. CT thorax with contrast obtained on admission demonstrating no pulmonary infiltrates and no filling defects suspicious for pulmonary embolism.

anti-nuclear antibody returned negative. Later that day the patient was downgraded from the ICU to the medicine service.

On hospital day 6 a colonoscopy/EGD was performed. Colonoscopy biopsies revealed colonic mucosa showing mild inflammation with moderate increase in number of lymphoplasmacytic infiltrates. EGD revealed chronic gastritis and a single clean base gastric ulcer. All antibiotics were then discontinued. The patient was discharged late that evening with prescriptions for high dose aspirin 650 mg 3 times daily to complete 8 weeks of therapy and colchicine 0.6 mg twice a day for 3 months of therapy. Patient was advised to obtain Cardiac CT angiography as outpatient when appropriate.

The patient was seen for a follow up after completion of his therapy. Repeat EKG showed no ST segment deviations and T wave inversion resolution. He reported that his activity had returned to baseline and that he had been exercising regularly without difficulties. Repeat echocardiogram was ordered for the patient; but has not yet been performed at the time of writing.

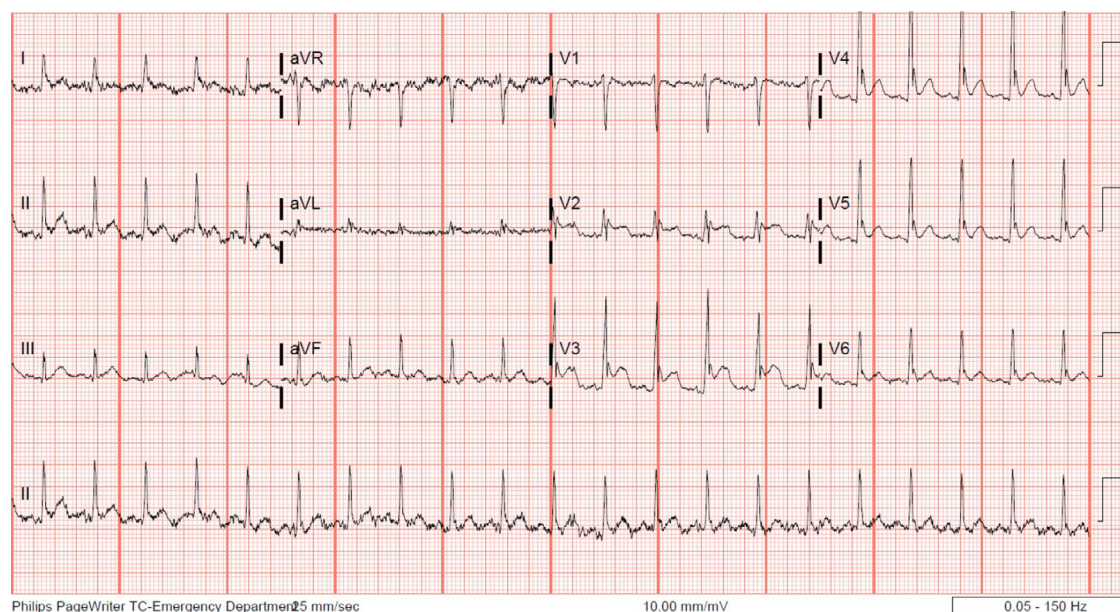


Fig. 1. Serial EKGs reviewed ST elevations lateral/antrolateral leads without reciprocal depressions.

Table 1.
Echocardiography findings on days 1 and 2 of admission.

	Normal values	Day 1	Day 2
Aortic root, cm	2.4–3.7	3.17	3.17
Left atrium, cm	1.9–4.0	3.34	2.55
LA volume index, ml/m ²	20±6	16.8	-----
Intraventricular septum end diastole, cm	0.7–1.1	0.66	1.00
Left ventricular posterior wall end diastole, cm	0.7–1.1	1.05	1.09
Left ventricular internal diameter end diastole, cm	3.4–5.7	4.58	5.01
Left ventricular internal diameter end systole, cm	2.0–4.0	3.65	3.86
Left ventricular fractional shortening,%	>25	20.3	23.0
Left ventricular ejection fraction,%	>50	41.6	45.9
Relative wall thickness	0.32–0.42	0.37	0.42
Left ventricular mass, g		130.2	197.8
Left ventricular mass index, g/m ²	70 ± 9	71.8	111.2
Physician estimated left ventricular ejection fraction,%	>50	55–60%	50%
Right ventricular systolic pressure, mmHg	20–30	35	25

Discussion

Myocardial injury associated with COVID-19 infection had been widely described during the earlier months of the COVID-19 pandemic, where upwards of approximately 17% of inpatients had elevations in cardiac markers, with a greater association with ICU admission vs medical wards (31 vs 4%), carrying a mortality of 46% vs 1%.^{4,11,14}

The gold standard of diagnosing myocardial involvement is endomyocardial biopsy, however due to its invasiveness it is generally underutilized, and even more so with the advent of COVID-19 in the recent months. Thus, cardiac magnetic resonance imaging (CMR) has become the preferred non-invasive test for myocarditis.^{2,13} On CMR, a high T2 signal and non-ischemic late enhancement on cardiac MRI is characteristic of myocarditis. Symptoms such as chest pain and new LV dysfunction may be related to myocarditis, however the American College of Cardiology (ACC) recommends performing CMR only after coronary artery disease (CAD) has been ruled out due to its higher pre-test probability in the general population for ischemia than acute myocarditis, as it is far less common.¹² Unfortunately, our institution currently lacks CMR and due to isolation precautions for COVID-19 Cardiac CT has become prohibitively complex for our institution. However, in our patient, the pretest probability of CAD remains low as the patient is 32 years old, lacked any significant comorbidities, was a lifelong non-smoker, and denied any family history of premature CAD.

Our case is the first case of COVID-19 induced myopericarditis to demonstrate no CT evidence of pulmonary involvement. Similar case reports include one by Paul et al.⁸ which demonstrated significant COVID-19 myocarditis in a young patient (35-year-old) without any CT evidence of pulmonary involvement, and a case by Hua et al. of life-threatening cardiac tamponade complicating myopericarditis with minimal x-ray evidence of pulmonary disease.³

There is increased interest in CMR for surveillance of survivors of COVID-19; as Puntmann and Chilazi demonstrated ongoing myocardial inflammation in 60% of patients at a median follow up of 71 days.^{10,2} A recent German cohort of 100 patients who had recently recovered from COVID-19 demonstrated that approximately 60% of

these patients had evidence of myocardial inflammation. Of these, approximately 70% had a detectable troponin T level (hsTnT >3 pg/mL) while 5% had a troponin raised above the reference range (>13.9 pg/mL). Additionally, 20% were found to have a pericardial effusion >1 cm.^{6,10} The degree of cardiac involvement thus may or may not correlate well with pulmonary involvement as demonstrated by this case and priors.^{3,7,8} Patients may also not present in the acute phase of the illness as our patient repeatedly tested negative on PCR testing for SARS-CoV-2 but positive on antibody testing Table 1.

Conclusion

This case highlights occult myopericarditis after recovery from prior COVID-19 infection. Myocardial inflammation is common in COVID-19; however, life threatening carditis remains rare. The degree of cardiac involvement poorly correlates with pulmonary involvement; as evident from prior cases. One must keep in mind about the various extra-pulmonary COVID-19 sequelae that may manifest even after recovery from the infection.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Caforio ALP. COVID-19: cardiac manifestations in adults. In: Post TW, ed. *UpToDate*. Waltham, MA: UpToDate; 2021. Accessed on July 10.
2. Chilazi M, Duffy EY, Thakkar A, et al. COVID and cardiovascular disease: what we know in 2021. *Curr Atheroscler Rep*. 2021;23(7):37. <https://doi.org/10.1007/s11883-021-00935-2>. May 13PMID: 33983522; PMID: PMC8117457.
3. Hua A, O'Gallagher K, Sado D, et al. Life-threatening cardiac tamponade complicating myo-pericarditis in COVID-19. *Eur Heart J*. 2020;41:2130.
4. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan. *China. Lancet*. 2020;395:497–506. [https://doi.org/10.1016/S0140-6736\(20\)30183-5](https://doi.org/10.1016/S0140-6736(20)30183-5).
5. Laganà N, Cei M, Evangelista I, et al. Suspected myocarditis in patients with COVID-19: a multicenter case series. *Medicine*. 2021;100(8):e24552. <https://doi.org/10.1097/MD.00000000000024552>. (Baltimore).
6. O'Gallagher K, et al. American college of cardiology. *J. Am. Coll. Cardiol*. 2020. www.acc.org/latest-in-cardiology/articles/2020/09/25/17/22/covid-19-myopericarditis.
7. Paladino FAT, Valdígem B, Lopes H. COVID-19: cardiovascular involvement without pulmonary signs. *Curr Trend Cardiol*. 2020;4(2):48–50.
8. Paul JF, Charles P, Richaud C, et al. Myocarditis revealing COVID-19 infection in a young patient. *Eur Heart J Cardiovasc Imaging*. 2020;21(7):776. <https://doi.org/10.1093/ehjci/jeaa107>.
9. Peretto G, Villatore A, Rizzo S, et al. The Spectrum of COVID-19-Associated Myocarditis: a Patient-Tailored Multidisciplinary Approach. *J Clin Med*. 2021 May 4;10(9):1974. <https://doi.org/10.3390/jcm10091974>. PMID: 34064463; PMID: PMC8124580.
10. Puntmann VO, Carerj ML, Wieters I, et al. Outcomes of cardiovascular magnetic resonance imaging in patients recently recovered from coronavirus disease 2019 (COVID-19). *JAMA Cardiol*. 2020. Jul 27:[Epub ahead of print].
11. Ramadan MS, Bertolino L, Marrazzo T, et al. Cardiac complications during the active phase of COVID-19: review of the current evidence. *Intern Emerg Med*. 2021;27:1–11. <https://doi.org/10.1007/s11739-021-02763-3>. MayEpub ahead of print. PMID: 34046852; PMID: PMC8158084.
12. Rudski L, Januzzi JL, Rigolin VH, et al. Multimodality Imaging in Evaluation of Cardiovascular Complications in Patients With COVID-19: JACC Scientific Expert Panel. *J Am Coll Cardiol*. 2020;76(11):1345–1357. <https://doi.org/10.1016/j.jacc.2020.06.080>.
13. Sanghvi SK, Schwarzman LS, Nazir NT. Cardiac MRI and myocardial injury in COVID-19: diagnosis, risk stratification and prognosis. *Diagnostics*. 2021;11(1). <https://doi.org/10.3390/diagnostics11010130>.
14. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020;395:1054–1062. [https://doi.org/10.1016/s0140-6736\(20\)30566-3](https://doi.org/10.1016/s0140-6736(20)30566-3).