Longitudinal Follow-Up of Asymptomatic COVID-19 Myocarditis with Cardiac Magnetic Resonance Imaging

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Patient: Male, 23-year-old
Final Diagnosis: Myopericarditis
Symptoms: Chest discomfort
Medication: —
Clinical Procedure: —
Specialty: Cardiology • Cardiology • Infectious Diseases

Objective: Unusual clinical course
Background: Varying degrees of cardiovascular involvement have been noted with COVID-19, with myocarditis being one of the feared complications. We present the case of a healthy, young individual with persistent myocardial involvement on cardiac magnetic resonance (CMR) imaging at 10 months’ follow-up.

Case Report: A 23-year-old man with no prior medical conditions presented to our outpatient cardiology clinic with a chief concern of left-sided exertional chest discomfort of 1-week duration, lasting 30-60 min before resolving. The patient was previously active and ran 2 miles per day, 6 days a week without any issues. Three months prior to presentation, the patient had a mild case of COVID-19 managed conservatively on an outpatient basis. On evaluation, the vital signs, physical examination, and laboratory work-up were unremarkable. Electrocardiography (EKG) displayed normal sinus rhythm with incomplete right bundle branch block. Transthoracic echocardiography (TTE) was normal. CMR was performed and indicated myopericarditis in several sub-epicardial and pericardial segments, with a quantitative scar burden of 18.6% on late gadolinium enhancement (LGE) images using the mean+5 SD method. A repeat CMR 7 months later demonstrated persistent sub-epicardial fibrosis with improvement in the LGE burden to 5.1% and resolution of pericarditis.

Conclusions: Myopericarditis with persistent myocardial scarring can be detected using CMR in healthy individuals with mild COVID-19 symptoms. The exact prevalence and potential clinical implications of this entity is unclear and warrants further longitudinal research.

Keywords: Cardiac Imaging Techniques • COVID-19 Breakthrough Infections • Magnetic Resonance Imaging, Cine • Myocarditis • Pericarditis

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/935492
**Background**

Varying degrees of cardiovascular involvement have been noted with the COVID-19 disease, with myocarditis being a feared complication. Data on management and prognosis of myocarditis in these patients are lacking, and there is little information regarding persistent LGE and myocardial scarring in acute post-COVID-19 syndrome. In this case report we present a healthy, young individual with persistent myocardial involvement on CMR at 10 months’ follow-up.

**Case Report**

A 23-year-old man with no prior medical conditions presented to our outpatient cardiology clinic with a chief concern of left-sided exertional chest discomfort of 1-week duration, lasting 30-60 min before resolving. The patient was previously active and ran 2 miles per day, 6 days a week without any issues. Three months prior to presentation, the patient had mild COVID-19 managed conservatively in the outpatient setting. Medical, surgical, and social history were unremarkable. A review of systems was positive for fatigue. Vital signs were within normal limits. A physical examination demonstrated no cardiopulmonary abnormalities. Comprehensive laboratory evaluation was unremarkable. Serum troponin was 12 ng/l (reference range 0-30 ng/l) and BNP (B-type natriuretic peptide) was <10 pg/ml (reference range ≤100 pg/ml). EKG demonstrated sinus bradycardia and an incomplete right bundle branch block (**Figure 1**). TTE revealed a left ventricular ejection fraction (LVEF) of 60% with no valvular or wall motion abnormalities. Given his current symptoms and prior COVID-19, CMR was ordered to evaluate for possible myocarditis. CMR was performed on a 1.5T Siemens scanner (Magnetom Aera/Gradient Spec XI/Software version: VE11E). Various imaging sequences were performed, including: SSFP (steady-state free precession) cine images, along with tissue characterization using T1 map shortened Modified Look-Locker Inversion recovery sequence (ShMOLLI), T2 map images, and LGE images using phase-sensitive inversion recovery (PSIR) sequence. CMR demonstrated a mildly dilated right atrium, but the rest of the cardiac chambers were normal in size. There was a normal LVEF of 54% and trace pericardial effusion was visualized. Global native T1 and T2 values were normal, indicating an absence of myocardial edema. The LGE images indicated the presence of several areas of sub-epicardial as well as pericardial enhancement, suggestive of myopericarditis, with a quantitative LGE burden of 18.6% (using the mean+5 SD method) (**Figures 2, 3**). A medical regimen of colchicine 0.6 mg twice daily for 3 months and ibuprofen 600 mg 3 times daily for 14 days was initiated. At 1-month follow-up, there was resolution of symptoms and a treadmill stress test was performed, which revealed good exercise capacity with no symptoms or EKG abnormalities at 17 METS. A repeat CMR was performed 7 months after initial presentation, which demonstrated persistent sub-epicardial fibrosis in the same distribution as the initially detected myopericarditis, with improvement in the LGE burden to 5.1% and resolution of pericarditis (**Figures 4, 5**).

**Figure 1.** EKG on presentation revealing sinus bradycardia with incomplete right bundle branch block (RBBB).
Figure 2. Initial CMR obtained 3 months after COVID-19. The left-side column shows the steady-state free precession (SSFP) images, while the right column shows the corresponding phase-sensitive inversion recovery (PSIR). A-D respectively shows the 4-chamber, 2-chamber, 3-chamber, and short-axis views. The blue arrows point to areas of sub-epicardial scarring and yellow arrows show pericardial enhancement.

Figure 3. Initial CMR quantitative scar burden assessment on late gadolinium-enhanced images revealed a total scar burden of 18.6%.

Discussion

Cardiovascular implications of COVID-19 disease include myocarditis, pericarditis, arrhythmias, postural orthostatic tachycardia syndrome, and unmasking of underlying CAD [1]. Given the advanced tissue characterization capabilities of CMR, it has been utilized in a wide variety of COVID-19 patients with cardiac concerns ranging from asymptomatic to severe disease.

Myocarditis on CMR is diagnosed acutely based on the Lake Louis or modified Lake Louis criteria [2]. However, in sub-acute or chronic settings, tissue edema or scarring on CMR have been considered markers for the presence of myocarditis. Reports suggest the prevalence of LGE in a non-ischemic pattern is present up to 6 months after COVID-19 infection and the implication of this persistent myocardial scarring is unknown [3-5].

The presence of myopericarditis in a young, healthy individual with mild clinical symptoms is concerning as it may represent a large population with undetected myocardial involvement with potential future consequences. In symptomatic acute non-COVID myocarditis, CMR reported complete resolution of myocarditis in only 11% of individuals at 6-month follow-up [6]. This study noted that patients with LGE without myocardial edema had increased major cardiac events, including cardiac arrest, implantable cardiac defibrillator shock, and heart transplant, as well as heart failure hospitalizations (P<0.0001). Patients with increased LGE extent at the time of follow-up had a worse prognosis [6].

Currently, accurate prediction of cardiac complications including myopericarditis in COVID-19 patients is difficult [7,8]. A systematic review showed that myocardial involvement in COVID-19 correlates with worse prognosis, but the presence...
Figure 4. Follow-up CMR obtained 7 months after the initial CMR. The left-side column shows the steady-state free precession (SSFP) images, while the right column shows the corresponding phase-sensitive inversion recovery (PSIR) images. Images A-D show the 4-chamber, 2-chamber, 3-chamber, and short-axis views, respectively. The blue arrows point to areas of sub-epicardial scarring. Of note, no obvious pericardial enhancement was noted. Also, a focal area of epicardial enhancement seen in the basal short-axis seen on the first CMR resolved on the follow-up study (D).

Figure 5. Follow-up CMR quantitative scar burden assessment on late gadolinium-enhanced images revealed a persistent but improved total scar burden of 5.1%.

of myocarditis by itself was not noted to be a poor prognosticator [9]. Further longitudinal research pertaining to persistent LGE on CMR and associated clinical outcomes is warranted.

Conclusions

Extensive myopericarditis with persistent myocardial scarring can be detected using CMR in healthy individuals with mild COVID-19 symptoms. The exact prevalence and potential clinical implications of this entity is unclear and warrants further longitudinal research.

Declaration of Figures’ Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.
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