

Patterns of cardiac involvement in patients with long COVID syndrome using cardiovascular magnetic resonance

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Background: Long COVID (LC) is an increasingly recognized late complication of COVID-19 infection. Cardiovascular involvement has also been implicated, however, the type and extent of the underlying cardiovascular injury remains unknown.

Purpose: To evaluate the association between ongoing symptoms and findings with cardiovascular magnetic resonance (CMR) in consecutive patients recently recovered from COVID-19 illness.

Methods: Prospective observational cohort study of patients recently recovered from COVID-19 illness and no previously known cardiovascular disease were included between April 2020 and April 2021. Demographic characteristics, cardiac blood markers, and CMR imaging a minimum of 4 weeks from the diagnosis were obtained.

Results: Of the 389 included patients, 192 (49%) were male, the mean (\pm standard deviation) age was 44 (\pm 13) years and 61 (16%) required hospitalization during the acute illness. The median (IQR) time interval between COVID-19 diagnosis and CMR was 94 (71–165) days. 298 (77%) of patients continued to experience ongoing cardiovascular symptoms (long COVID, LC), including dyspnea, palpitations, atypical chest pain and fatigue at the time of CMR at least 4 weeks after the infection. In most patients, the symptoms were only effort related 137 (46%), whereas in 98

(33%) the symptoms affected the activities of daily life; 10 (3%) had severe and debilitating symptoms at rest. Compared to those with no LC (NLC, n=91), LC patients were more commonly hospitalized, had significantly higher native T1, native T2, and showed pericardial enhancement and effusion (Figure 1). There were no differences in cardiac biomarkers, left ventricular (LV) and right ventricular ejection fraction and mass. Proportionally, men and women were similarly affected (n=144 (73%) vs. n=157 (80%), p=0.18). Previous hospitalization was associated with hypertension and ongoing detectable troponin. LC status was associated with previous hospitalization and CMR findings of raised native T1 and native T2, and in females also pericardial enhancement. Severity of symptoms were associated with increased native T1 and T2 and decreased end-diastolic volume, whereas cardiac function showed no significant difference.

Conclusions: In this cohort of patients recently recovered from COVID-19 infection, ongoing cardiovascular symptoms were common. The LC status was related to previous hospitalization and CMR imaging findings of myopericardial inflammation. The extent and type of cardiovascular findings was associated with the severity of symptoms. These findings indicate the need for ongoing investigation of the long-term cardiovascular consequences of COVID-19.

