Cardiac injury before and after COVID-19. A longitudinal MRI study

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Background: Recent MRI-based studies have raised great concern about frequent cardiac involvement even in mild or asymptomatic COVID-19. However, while signs of myocardial injury were found in large proportions of patients after COVID-19, all studies published to date lack baseline imaging and are therefore unable to discriminate between pre-existing and COVID-19-induced injury.

Purpose: In this longitudinal study, we aimed to assess the true cardiac impact of COVID-19 based on pre- and post-COVID-19 late gadolinium enhancement (LGE)-MRI.

Methods: A prospective registry of patients with serial LGE-MRIs was screened for patients with documented SARS-COV-2 infection after cardiac LGE-MRI. Eligible patients then received a post-COVID-19 LGE-MRI using the same scanner and sequence as in the pre-COVID-19 MRI. Inversion recovery prepared T1-weighted gradient echo sequences were acquired in sinus rhythm using ECG gating and a free-breathing 3D navigator, 15–20 minutes after administering an intravenous bolus of 0.2 mmol/kg of gadobutrol. A TI scout sequence was used in order to determine the optimal TI that nullified the left ventricular myocardial signal. The presence of LGE was independently assessed qualitatively by two experienced investigators blinded to patient information. For quantitative analyses a 3D-reconstruction of the left ventricle was performed using ADAS-3D software. LGE was then automatically quantified based on a prespecified signal intensity threshold of ≥3 SD above the mean of a remote non-enhanced myocardial region.

Results: Pre- and post-COVID LGE-MRI from 31 patients with cardiovascular risk factors that had recovered from mild to moderate COVID-19 (23% hospitalised) were analysed. At a median of 5 months post-COVID-19, LGE-lesions indicative of myocardial injury were encountered in 15 out of 31 patients (48%), which is in line with previous reports. However, intraindividual comparison with the pre-COVID-19 MRI reveiled all of these lesions as pre-existing and thus not COVID-19-related. Quantitative analysis detected no increase in the size of individual LGE-lesions, nor in the global left ventricular LGE-extent. There was no difference in any functional or structural parameter between pre- and post-COVID-19 MRI.

Conclusion: This longitudinal study in a cohort of patients considered at high risk of cardiac involvement, did not find any evidence for COVID-19-induced myocardial injury. The complete absence of de novo LGE lesions in this cohort is reassuring and indicates that cardiac sequelae of COVID-19 are rare and certainly not as common as previously suggested.

Corresponding LGE-lesions pre- and post-COVID-19 – representative cases

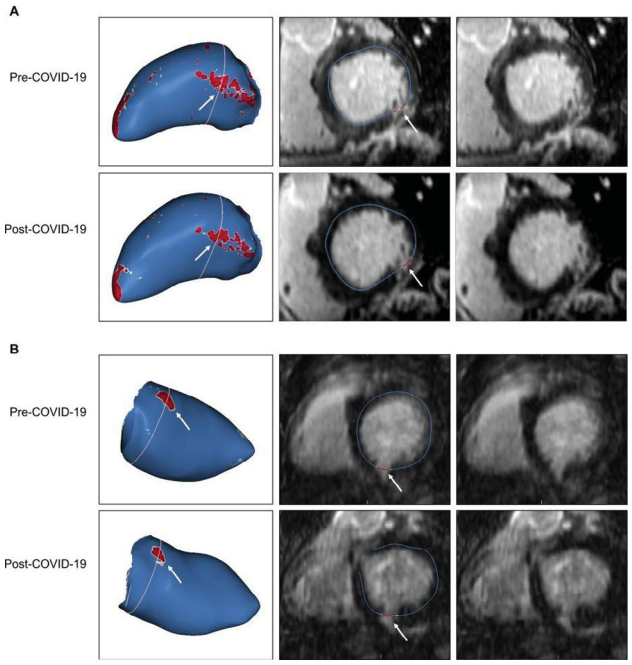

Figure 1

Qualitative LGE analysis pre- and post-COVID-19

Patient	LGE pre-COVID-19			LGE post-COVID-19			Changes
	LGE present	AHA-segments	(transm.) extent / pattern	LGE presentR	AHA-segments	(transm.) extent / pattern	
1	yes	RVIP	n.a.	yes	RVIP	n.a.	unchanged
2	yes	2; RVIP	mid; n.a.	yes	2; RVIP	mid; n.a.	unchanged
3	yes	2	mid	yes	2	mid	unchanged
4	no	-	-	no	-	-	unchanged
5	yes	4; 2	trans; mid	yes	4; 2	trans; mid	unchanged
6	yes	8,9; RVIP	trans; n.a.	yes	8,9; RVIP	trans; n.a.	unchanged
7	yes	2, RVIP	mid. n.a.	yes	2, RVIP	mid. n.a.	unchanged
8	no	-	-	no	-	-	unchanged
9	no	-	-	no	-	-	unchanged
10	yes	RVIP	n.a.	yes	RVIP	n.a.	unchanged
11	yes	RVIP	n.a.	yes	RVIP	n.a.	unchanged
12	yes	4	mid	yes	4	mid	unchanged
13	no	-	-	no	-	-	unchanged
14	no	-	-	no	-	-	unchanged
15	yes	2,3	mid	yes	2,3	mid	unchanged
16	yes	5,11; 4,3; RVIP	trans; mid; n.a.	yes	5,11; 4,3; RVIP	trans; mid; n.a.	unchanged
17	no	-	-	no	-	-	unchanged
18	no	-	-	no	-	-	unchanged
19	yes	5	mid	yes	5	mid	unchanged
20	yes	7	mid	yes	7	mid	unchanged
21	no	-	-	no	-	-	unchanged
22	no	-	-	no	-	-	unchanged
23	yes	5	subendo	yes	5	subendo	unchanged
24	yes	RVIP	n.a.	yes	RVIP	n.a.	unchanged
25	yes	RVIP	n.a.	yes	RVIP	n.a.	unchanged
26	yes	2; RVIP	mid; n.a.	yes	2; RVIP	mid; n.a.	unchanged
27	yes	2,3	mid	Yes	2,3	mid	unchanged
28	no	-	-	no	-	-	unchanged
29	yes	RVIP	n.a.	yes	RVIP	n.a.	unchanged
30	yes	2	subendo	yes	2	subendo	unchanged
31	yes	3,4	subendo	yes	3,4	subendo	unchanged

Independent lesions are separated by semicolon, confluent lesions by comma. RVIP = right ventricular insertion point (AHA segments and transmural extent do not apply in RIVP); mid = mid-myocardial; trans = transmural; subendo = sub-endocardial.

Table 1