METHODS:

Pulmonary function tests (PFT):

PFTs included spirometry, plethysmography and lung transfer factor for carbon monoxide (TLco) measurements using the single breath method tests were done. The latest ATS/ERS guidelines were followed for all lung function measurements.[1–3]

TLco results were referenced to predicted values corrected for the patient's hemoglobin level. We used the most recent reference values from GLI project (calculation made in February 2023, after equation correction for TLCO) for all lung function measurements defining the lower limit of normal (LLN) at the level of z-score equal to -1.645.[4-7]

The 6MWT was conducted in accordance with ATS guidelines.[8]

Cardiac magnetic resonance (CMR):

CMR was performed using a clinical MR 1.5 T system (Ingenia 1.5T; Philips Healthcare, Best, the Netherlands) using a dStream thorso coil. The imaging protocol included myocardial function, tissue oedema and necrosis/fibrosis assessment. SSFP sequences with ECG gating were used for function assessment. Black blood T2-weighted STIR TSE (short-tau inversion-recovery turbo spin echo) images were performed for oedema assessment. Focally increased signal intensity or globally increased over 2,0 cardiac muscle/skeletal

muscle ratio on T2-weighted SITR images measured on the same image was marked as oedema. Necrosis/fibrosis was detected on late gadolinium enhanced (LGE) T1-weighted IR gradient echo images, obtained 10-25 min. after administration of 0,1 mmol/kg b.w. Gd-based contrast agent, gadobutrol (Gadovist; Bayer Healthcare, Leverkusen, Germany). Inversion time was individually adjusted based on look-locker images to null the signal from a healthy cardiac muscle. Presence of any hyperintensity area on LGE images were classified according to its localization into ischemic pattern (subendocardial) and non-ischemic pattern (intramural, subepicardial). All imaging sequences were obtained in short axis orientation covering the whole ventricles and at least one in left ventricular long axis, four and five chamber views. For LGE whole heart 3D IR GRE with fat saturation and navigator gating was used. According to Lake Louise Criteria (2018) acute myocarditis was diagnosed if both non-ischemic pattern of LGE and oedema were present. Presence of non-ischemic LGE pattern in absence of oedema and hypertrophy were classified as healed myocarditis. Presence of ischemic LGE pattern in presence or absence of oedema were classified accordingly as acute or previous myocardial infarction. Pericardial hyperintensity on T2-weihted STIR images and enhancement on 3D IR GRE fat sat images, regardless of presence or absence pericardial effusion, were classified as acute pericarditis.

The study was conducted after the patient signed the consent and provided that there are no contraindications to CMR.

RESULTS:

Table S1. Study group characteristics.

	n=	Numbers and frequency in % or median and interquartile range where appropriate

Demographic/epidemiologic data:		
Males	75	46 (61.3%)
Age, years	75	59 (46 - 66)
BMI, kg/m^2	75	28.43 (25.39 - 31.88)
ever smokers	75	28 (37.3%)
heart related comorbid disease	75	25 (33.3%)
Acute phase of the COVID-19:		
Lung involvement in HRCT, %	75	50 (30 - 60)
WBC, x10^9/L	65	5.8 (4.5 - 7.7)
CRP, mg/L	66	73.5 (43 - 161)
IL-6, pg/ml	64	34.55 (21.6 - 74.45)
NT-proBNP, pg/ml	55	127 (54.7 - 312)
required oxygen therapy	75	55 (73.3%)
required mechanical ventilation	75	1 (1.3%)
treated with antiviral agents	75	43 (57.3%)
treated with dexamethasone	75	42 (56%)
loss of smell/taste	75	35 (46.7%)
Symptoms after acute phase		
cough (persistent)	75	36 (48%)
dyspnoe (persistent)	75	4 (5.3%)
exercise intolerance	75	35 (46.7%)
any symptom	75	57 (76%)
Lung function shortly after the acute phase (7-30 days):		
FEV1/FVC, z-score airway obstruction (low FEV1/FVC<LLN)	75	0.25 (-0.5 - 0.73) 4 (5.3%)
TLC, z-score TLC, %pred.	74	-0.41 (-1.07 - 0.34) 95.09 (86.78 - 104.39)

Restriction (TLC below LLN)		11 (14.7%)
FVC, z-score FVC, %pred low FVC (below LLN)	75	-0.33 (-1.13 - 0.4) 95.25 (83.75 - 106.32) 12 (16%)
FEV1, z-score FEV1, %pred.	75	-0.38 (-0.8 - 0.45) 95.19 (86.49 - 107.27)
TLco, z-score TLco, %pred. Low TLco (below LLN)	75	-1.12 (-1.82 - -0.07) 83.17 (73.13 - 98.92) 23 (30.7%)
6MWD, m	74	573 (480 - 648)

WBC – white blood count, CRP – C-reactive protein, IL-6 – interleukin 6, NT-proBNP – N-terminal pro b-type natriuretic peptide, HRCT – high resolution computed tomography, FEV1 – forced expiratory volume at 1 s., FVC – forced vital capacity, TLC – total lung capacity, TLco – lung transfer factor for carbon monoxide, 6MWD – 6 minute walking distance.
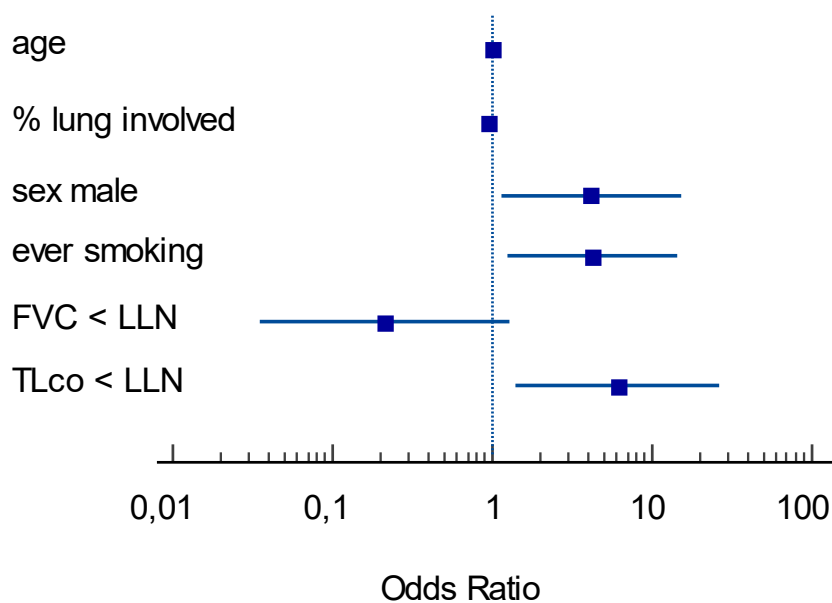
Figure S1.

Figure S1, Forest plot of odds ratios for factors associated with myocarditis after COVID-19 pneumonia. Odds ratios were derived from logistic regression model. % lung involved – percentage of lung affected in high resolution computed tomography in acute phase; TLco – lung transfer factor for carbon monoxide; FVC – forced vital capacity.

Reference List 1. (for "Methods" section in Supplementary material)

[1]   Graham BL, Steenbruggen I, Miller MR, Barjaktarevic IZ, Cooper BG, Hall GL, et al. Standardization of Spirometry 2019 Update. An Official American Thoracic Society and European Respiratory Society Technical Statement. Am J Respir Crit Care Med 2019;200:e70–88.

[2]   Graham BL, Brusasco V, Burgos F, et al. 2017 ERS/ATS standards for single-breath carbon monoxide uptake in the lung [published correction appears in Eur Respir J. 2018 Nov 22;52(5):]. Eur Respir J. 2017;49:1600016.

[3]   Wanger J, Clausen JL, Coates A, Pedersen OF, Brusasco V, Burgos F, et al. Standardisation of the measurement of lung volumes. Eur Respir J 2005;26:511–522.

[4]   Quanjer PH, Stanojevic S, Cole TJ, Baur X, Hall GL, Culver BH, et al. Multi-ethnic reference values for spirometry for the 3-95-yr age range: the global lung function 2012 equations. Eur Respir J 2012;40:1324–1343.

[5]   Stanojevic S, Graham BL, Cooper BG, et al. Official ERS technical standards: Global Lung Function Initiative reference values for the carbon monoxide transfer factor for Caucasians [published correction appears in Eur Respir J. 2020 Oct 15;56:]. Eur Respir J. 2017;50:1700010.

[6]   Stanojevic S, Kaminsky DA, Miller MR, et al. ERS/ATS technical standard on interpretive strategies for routine lung function tests. Eur Respir J. 2022;60:2101499.

[7]   Hall GL, Filipow N, Ruppel G, et al. Official ERS technical standard: Global Lung Function Initiative reference values for static lung volumes in individuals of European ancestry. Eur Respir J. 2021;57:2000289.

[8]   ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test [published correction appears in Am J Respir Crit Care Med. 2016 May 15;193:1185]. Am J Respir Crit Care Med. 2002;166:111-117.

Reference List 2. (for Disscusion section in main text)

[S16] Rajpal S, Tong MS, Borchers J, Zareba KM, Obarski TP, Simonetti OP, et al. Cardiovascular Magnetic Resonance Findings in Competitive Athletes Recovering From COVID-19 Infection. JAMA Cardiol 2021;6:116–118.

[S17] Małek ŁA, Marczak M, Miłosz-Wieczorek B, et al. Cardiac involvement in consecutive elite athletes recovered from Covid-19: A magnetic resonance study. J Magn Reson Imaging 2021; 53: 1723–1729.

[S18] Daniels CJ, Rajpal S, Greenshields JT, et al. Prevalence of Clinical and Subclinical Myocarditis in Competitive Athletes With Recent SARS-CoV-2 Infection: Results From the Big Ten COVID-19 Cardiac Registry. JAMA Cardiol 2021; 6: 1078–1087.

[S19] Zheng Y, Xu H, Yang M, et al. Epidemiological characteristics and clinical features of 32 critical and 67 noncritical cases of COVID-19 in Chengdu. J Clin Virol Off Publ Pan Am Soc Clin Virol 2020; 127: 104366.

[S20] CDC. COVID-19 Vaccination. Centers for Disease Control and Prevention, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/safety/myocarditis.html (2020, accessed 17 November 2022).

[S21] Boehmer TK, Kompaniyets L, Lavery AM, et al. Association Between COVID-19 and Myocarditis Using Hospital-Based Administrative Data - United States, March 2020-January 2021. MMWR Morb Mortal Wkly Rep. 2021;70:1228-1232.

[S22] Urban S, Fułek M, Błaziak M, et al. COVID-19 Related Myocarditis in Adults: A Systematic Review of Case Reports. J Clin Med 2022; 11: 5519.

[S23] Barcena ML, Jeuthe S, Niehues MH, et al. Sex-Specific Differences of the Inflammatory State in Experimental Autoimmune Myocarditis. Front Immunol 2021; 12: 686384.

[S24] Pérez-González A, Araújo-Ameijeiras A, Fernández-Villar A, et al. Long COVID in hospitalized and non-hospitalized patients in a large cohort in Northwest Spain, a prospective cohort study. Sci Rep 2022; 12: 3369.

[S25] Mo X, Jian W, Su Z, et al. Abnormal pulmonary function in COVID-19 patients at time of hospital discharge. Eur Respir J 2020; 55: 2001217.

[S26] Thomas M, Price OJ, Hull JH. Pulmonary function and COVID-19. Curr Opin Physiol 2021; 21: 29–35.