

Post-COVID Myocarditis and Return-to-Play Recommendations in Young Competitive Athletes: A Prospective Screening Cohort with Six-Month Follow-up across Three Severity Tiers

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Abstract — Early in the COVID-19 pandemic, concern about post-infectious myocarditis prompted broad pre-participation screening of competitive athletes, with cardiac MRI used liberally across many programmes. Subsequent evidence has refined the clinical approach, with most current frameworks reserving advanced imaging for symptomatic or severely-affected athletes. We prospectively followed 215 competitive athletes (mean age 21.4 years; 138 male) after laboratory-confirmed COVID-19 infection, stratifying by symptom severity into mild (n=142), moderate (n=47), and severe (n=26) tiers. Resting ECG abnormalities were uncommon in the mild tier (2.1%) and progressively more frequent with severity (8.5% moderate; 23.1% severe). Cardiac MRI findings consistent with myocarditis were rare in mild illness (0.7%) but reached 14.9% in severely affected athletes. Median time to full return-to-play was 7 days in the mild tier, 16 days in the moderate tier, and 54 days in the severe tier. At six months, 184 athletes (85.6%) had returned to unrestricted training, 18 with modified intensity ramps, 9 remained under surveillance or restriction, and 4 withdrew from competition. A stratified triage approach with cardiac MRI reserved for the moderate-to-severe tiers appears safe and avoids the considerable downstream burden of universal imaging.

Keywords — COVID-19; Myocarditis; Sports Cardiology; Return-To-Play; Cardiac MRI; Athlete Screening; Troponin.

1. Introduction

Acute myocarditis is an established but uncommon complication of viral infection, and continued physical activity during the acute inflammatory phase has long been associated with worse outcomes. The COVID-19 pandemic introduced an unfamiliar pathogen into a population of competitive athletes whose training demands routinely push the cardiovascular system to its limits. Early case reports and small series suggested that myocarditis after SARS-CoV-2 might be more common than after other viral illnesses, prompting sports cardiology societies in many countries to issue cautious return-to-play frameworks that often-included routine cardiac MRI. As the evidence base grew, the picture changed. Large athlete registries showed that clinically meaningful cardiac involvement after COVID-19 occurred in less than 1% of mildly affected athletes, calling into question the value of routine advanced imaging. Updated frameworks have since emphasised stratification by illness severity, with resting ECG and troponin used as gatekeepers and cardiac MRI reserved for athletes with clinical or biochemical findings warranting further evaluation. The operational and economic case for this approach is strong, but practical implementation data from contemporary cohorts remain useful for centres designing local pathways (Jha, Kumar, & Neha, 2026; Kumar, Gautam, & Maitiy, 2026). We applied a severity-stratified return-to-play pathway in our sports cardiology

service for 18 months and prospectively followed athletes for six months after clearance. The aims were to describe the prevalence of cardiac findings by severity tier, to characterise time to full return-to-play, and to document six-month outcomes across the cohort (Sehgal, Jayapriya, & Kumar, 2026; Devi et al., 2025).

2. Methods

Competitive athletes aged 14-40 years were referred to a sports cardiology service for return-to-play assessment after laboratory-confirmed COVID-19 infection between September 2022 and March 2024. Inclusion required regular participation in organised competition at school, college, club, or professional level, and an interval of at least 7 days from symptom onset or positive test to first sports cardiology contact. Athletes with prior cardiac disease or congenital heart abnormalities were excluded. The final cohort comprised 215 athletes. Athletes were categorised by acute illness severity using a modified WHO framework. The mild tier included asymptomatic infection and infection with respiratory symptoms managed at home without supplemental oxygen. The moderate tier included infection with persistent fever for more than five days, myalgia or fatigue limiting daily activities for more than seven days, or any cardiopulmonary symptoms such as chest pain, palpitations, or exertional dyspnoea attributed to the infection. The severe tier comprised infections requiring hospitalisation, supplemental oxygen, or specific anti-

inflammatory therapy. The triage pathway is summarised in Figure 1. All athletes underwent symptom review, resting 12-lead ECG, and high-sensitivity troponin measurement at the first visit. Mild-tier athletes with normal initial investigations proceeded directly to a graded return-to-play protocol over 3-5 days. Moderate- and severe-tier athletes, and any athlete with abnormal initial investigations regardless of severity, underwent cardiac MRI with T1 and T2 mapping, late gadolinium enhancement assessment, and ventricular function evaluation. Specialist follow-up was provided for any athlete with MRI findings consistent with myocardial involvement.



Fig.1: Decision pathway for return-to-play assessment after COVID-19 in competitive athletes

A standardised graded return-to-play protocol was used, adapted from established post-myocarditis frameworks. Stage 1 involved light activity (50% maximum heart rate) for 1-2 days; subsequent stages incrementally increased intensity and duration, with progression contingent on absence of cardiac symptoms. The full pathway from cleared first visit to unrestricted training took 3-5 days in the mild tier, 7-21 days in the moderate tier, and 14+ days in the severe tier depending on MRI findings.

3. Results

3.1 Athlete Characteristics

Table 1. Athlete characteristics by COVID-19 severity tier

Characteristic	Mild (n=142)	Moderate (n=47)	Severe (n=26)
Age, mean (SD), years	20.4 (3.6)	22.1 (4.2)	24.8 (5.1)
Male sex, n (%)	91 (64.1)	30 (63.8)	17 (65.4)
Sport: endurance, n (%)	48 (33.8)	18 (38.3)	11 (42.3)
Sport: mixed, n (%)	58 (40.8)	19 (40.4)	10 (38.5)
Sport: power/ strength, n (%)	36 (25.4)	10 (21.3)	5 (19.2)
Competition level: elite	12 (8.5)	4 (8.5)	2 (7.7)
Competition level: collegiate	68 (47.9)	22 (46.8)	11 (42.3)
Competition level: club/school	62 (43.7)	21 (44.7)	13 (50.0)

Days from symptom onset to assessment, median	18	12	22
Hospitalisation during acute illness, n (%)	0	0	26 (100.0)
Persistent symptoms at assessment, n (%)	8 (5.6)	18 (38.3)	17 (65.4)

3.2 Investigation Findings by Severity Tier

Investigation findings tracked closely with severity. Resting ECG was abnormal in 3 of 142 mild-tier athletes (2.1%), 4 of 47 moderate-tier athletes (8.5%), and 6 of 26 severe-tier athletes (23.1%). High-sensitivity troponin was elevated in 2 mild-tier, 5 moderate-tier, and 8 severe-tier athletes. Cardiac MRI was performed in all moderate- and severe-tier athletes (n = 73) and in the 5 mild-tier athletes with abnormal initial investigations, a total of 78 studies (Figure 2). The most frequent MRI abnormality across the cohort was small pericardial effusion, which was generally clinically inconsequential. True features of acute myocarditis on cardiac MRI late gadolinium enhancement in a non-ischaemic distribution, with or without elevated T2 signal and regional dysfunction occurred in one mild-tier athlete with previously undiagnosed pericardial inflammation, 2 moderate-tier athletes, and 4 severe-tier athletes.

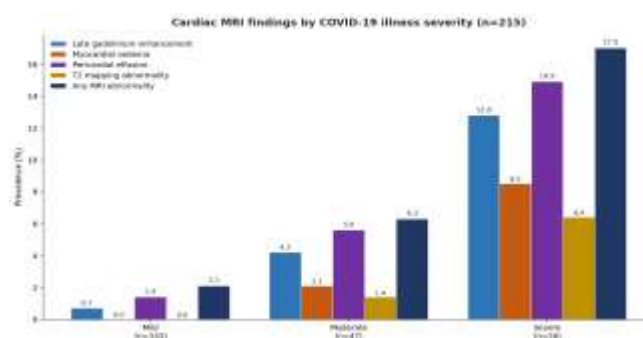


Fig.2: Cardiac MRI findings by COVID-19 illness severity. Severe illness was associated with substantially higher prevalence of any abnormality and of changes consistent with myocardial involvement

Table 2. Investigation results by severity tier

Finding	Mild (n=142)	Moderate (n=47)	Severe (n=26)
Abnormal resting ECG, n(%)	3 (2.1)	4 (8.5)	6(23.1)
Elevated hs-troponin, n (%)	2 (1.4)	5 (10.6)	8(30.8)
Cardiac MRI performed, n	5	47	26
Late gadolinium enhancement, n (%)	1 (0.7)	2 (4.3)	4 (15.4)
T2 mapping abnormality, n (%)	0 (0.0)	1 (2.1)	2 (7.7)
Pericardial effusion, n (%)	2 (1.4)	3 (6.4)	4 (15.4)
LVEF below 50%, n (%)	0 (0.0)	0 (0.0)	1 (3.8)

Any MRI abnormality, n (%)	3 (2.1)	3 (6.4)	5 (19.2)
MRI-confirmed myocarditis, n (%)	1 (0.7)	2 (4.3)	4 (15.4)
Arrhythmia on rhythm monitoring, n (%)	2 (1.4)	3 (6.4)	2 (7.7)

3.3 Time to Return-to-Play

Time from initial assessment to unrestricted training differed substantially across severity tiers (Figure 3). Mild-tier athletes typically resumed full training within a week, with most clearance achieved by day 7. Moderate-tier athletes required a median of 16 days for full clearance, with a long upper tail driven by those with MRI abnormalities. Severe-tier athletes showed the widest distribution, with median time to full return of 54 days; four athletes with confirmed myocarditis on MRI required restriction for the full guideline-recommended three to six months.



Fig.3: Time to full return-to-play by severity tier. Severe-tier athletes showed the widest distribution, reflecting heterogeneity in MRI findings

Table 3. Return-to-play timeline by severity tier

Metric	Mild (n=142)	Moderate (n=47)	Severe (n=26)
Time to first cleared training, days, median (IQR)	3 (3-4)	7 (5-10)	14 (10-21)
Time to unrestricted training, days, median (IQR)	7 (5-10)	16 (10-25)	54 (28-118)
Cleared by day 14, n (%)	138 (97.2)	32 (68.1)	6 (23.1)
Cleared by day 30, n (%)	142 (100.0)	44 (93.6)	12 (46.2)
Cleared by 90 days, n (%)	–	47 (100.0)	22 (84.6)
Required ≥90 days restriction, n (%)	0 (0.0)	0 (0.0)	4 (15.4)
Required specialist review beyond initial, n (%)	5 (3.5)	12 (25.5)	19 (73.1)

3.4 Six-Month Outcomes

At six months, 184 athletes (85.6%) had returned to unrestricted training without modification (Figure 4). Eighteen athletes (8.4%) returned with modified intensity ramps primarily moderate- and severe-tier athletes who completed the full restriction period and resumed competitive training under ongoing surveillance. Nine athletes (4.2%) remained under restriction or active surveillance, including the four with MRI-confirmed myocarditis still within their three-to-six-month restriction window. Four athletes (1.9%) withdrew from competition altogether for reasons including persistent post-COVID symptoms and individual decision; none of these withdrawals was driven by progressive cardiac findings.

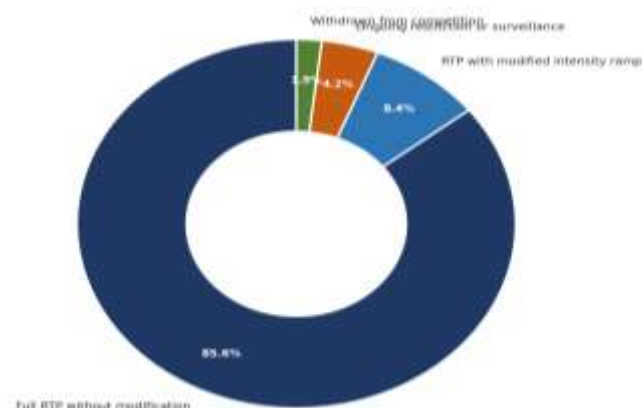


Fig.4: Six-month return-to-play outcomes across the full cohort (n=215)

Table 4. Six-month outcomes and adverse events

Outcome	Mild (n=142)	Moderate (n=47)	Severe (n=26)	Total (n=215)
Full unrestricted training	141 (99.3)	38 (80.9)	5 (19.2)	184 (85.6)
Modified intensity ramp	0 (0.0)	7 (14.9)	11 (42.3)	18 (8.4)
Restriction or surveillance	1 (0.7)	2 (4.3)	6 (23.1)	9 (4.2)
Withdrew from competition	0 (0.0)	0 (0.0)	4 (15.4)	4 (1.9)
New arrhythmia at 6 months	1 (0.7)	2 (4.3)	2 (7.7)	5 (2.3)
Hospitalisation for cardiac cause	0 (0.0)	0 (0.0)	1 (3.8)	1 (0.5)
Sudden cardiac event	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Persistent symptoms at 6 months	2 (1.4)	5 (10.6)	9 (34.6)	16 (7.4)

4. Discussion

Across 215 competitive athletes followed prospectively after COVID-19 infection, three findings inform practical return-to-play decision-making. First, in the large mild-tier

group, the prevalence of cardiac involvement was very low roughly seven per thousand for MRI-confirmed myocarditis and did not justify routine advanced imaging. The single mild-tier athlete with MRI evidence of myocardial involvement had elevated troponin on initial screening, so the resting ECG and troponin combination served as an effective gatekeeper. Second, moderate and severe illness produced a meaningful but still relatively modest yield of significant cardiac findings. Even in the severe tier, the majority of MRI studies showed either no abnormality or small clinically inconsequential pericardial effusions. The benefit of cardiac MRI in this group came from the small minority six athletes in total for whom the imaging identified clinically actionable myocarditis or substantial pericardial involvement requiring extended restriction. Third, six-month outcomes were broadly favourable. The great majority of athletes returned to unrestricted training, and no sudden cardiac events occurred across the cohort. The four athletes with MRI-confirmed myocarditis completed their restriction periods uneventfully and the majority returned to competition. The cohort of four athletes who withdrew from competition did so largely on the basis of persistent non-cardiac symptoms or personal decision rather than progressive cardiac disease a reminder that the long-COVID syndrome encompasses considerably more than cardiac findings (Jha, Kumar, & Neha, 2026; Sharma, Sharma, & Tyagi, 2026; Yatish, Khatoon, & Kumar, 2026). Practical implementation considerations include training of front-line clinical staff in symptom-grading and basic ECG interpretation, ready access to cardiac MRI within a reasonable timeframe for the athletes who need it, and clear communication with coaching and athletic-training staff about graded return protocols and progression milestones (Sehgal, Jayapriya, & Kumar, 2026; Bhatnagar, Tyagi, & John, 2026). Simulation-based training and structured handoffs between clinical and athletic-training teams help ensure that the graded ramp is followed in practice rather than truncated under competitive pressure (Vinodh, & Subramani, 2026; Catherine, Gupta, Gopi, & Swadhi, 2025; Vettriselvan, Ramya, et al., 2026). Limitations include the single-centre design, the relatively young and geographically homogeneous athlete population, and the six-month follow-up horizon which does not capture the longer-term durability of return. The evolution of viral variants over the 18-month accrual period may have influenced findings, particularly given the lower severity profile of more recent variants in younger populations. We did not perform routine cardiac MRI in mild-tier athletes with normal initial investigations, which means the true prevalence of clinically inapparent imaging abnormalities in this subgroup is unknown.

5. Conclusion

A severity-stratified return-to-play pathway combining symptom assessment, resting ECG, and troponin as

gatekeepers with cardiac MRI reserved for moderate- and severe-illness tiers and any athlete with abnormal initial investigations proved safe and operationally efficient across 215 competitive athletes. Most mild-tier athletes returned to unrestricted training within a week without advanced imaging. Cardiac MRI yielded clinically meaningful findings in a small minority of moderate- and severe-tier athletes for whom restriction was clearly warranted. Six-month outcomes were favourable across the cohort, and no sudden cardiac events occurred. The stratified approach avoids the substantial downstream burden of universal advanced imaging while reliably identifying the small subset of athletes who require it.

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