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Periodic health evaluation in athletes competing in Tokyo 2020: from SARS-CoV-2 to Olympic medals

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ABSTRACT

Background The Tokyo Olympic games were the only games postponed for a year in peacetime, which will be remembered as the COVID-19 Olympics. No data are currently available on the effect on athlete's performance.
Aim To examine the Italian Olympic athletes who have undergone the return to play (RTP) protocol after COVID-19 and their Olympic results.
Methods 642 Potential Olympics (PO) athletes competing in 19 summer sport disciplines were evaluated through a preparticipation screening protocol and, when necessary, with the RTP protocol. The protocol comprised blood tests, 12-lead resting ECG, transthoracic echocardiogram, cardiopulmonary exercise test, 24-hour Holter-ECG monitoring and cardiovascular MR based on clinical indication.
Results Of the 642 PO athletes evaluated, 384 participated at the Olympic Games, 254 being excluded for athletic reasons. 120 athletes of the total cohort of 642 PO were affected by COVID-19. They were evaluated with the RTP protocol before resuming physical activity after a mean detraining period of 30±13 days. Of them, 100 were selected for Olympic Games participation, 16 were excluded for athletic reasons and 4 were due to RTP results (2 for COVID-19-related myocarditis, 1 for pericarditis and 1 for complex ventricular arrhythmias). Among athletes with a history of COVID-19 allowed to resume physical activity after the RTP and selected for the Olympic Games, no one had abnormalities in cardiopulmonary exercise test parameters, and 28 became medal winners with 6 gold, 6 silver and 19 bronze medals.
Conclusions Among athletes with COVID-19, there is a low prevalence of cardiac sequelae. For those athletes allowed to resume physical activity after the RTP evaluation, the infection and the forced period of inactivity didn't have a negative impact on athletic performance.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Athletes resuming from COVID-19 have a low prevalence of cardiovascular sequelae.

WHAT THIS STUDY ADDS

⇒ Olympic athletes evaluated with RTP protocol before restarting physical activity and participating at the Olympic Games after COVID-19 do not have functional limitations.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ COVID-19 and a period of forced detraining do not negatively impact physical performance and athletes' results.

INTRODUCTION

The 2020 Olympic Games in Tokyo occurred during the COVID-19 pandemic and will be remembered as the COVID-19 Olympics. The Tokyo Games were unique as they represented the only Games postponed for a year during peace. SARS-CoV-2 infection and its clinical expression, known as COVID-19, affected the athletes by forcing them into an inactivity period (ie, detraining) and then to a new cardiovascular (CV) evaluation before the return to play (RTP).

During the pandemic, the Italian Sport Medicine Federation (FMSI) established the RTP protocol for athletes who tested positive for SARS-CoV-2.[1] All Olympic athletes, therefore, underwent the RTP protocol to resume eligibility for competitions given the 2020 Tokyo Olympic Games.

In this study, we sought to evaluate the prevalence of CV involvement after COVID-19 and to investigate the impact of deconditioning and resumption of training on the Olympic results.

METHODS

The Institute of Sports Medicine and Science in Rome is responsible for the medical evaluations of the elite athletes selected to participate in the Olympic Games. Between October 2020 and June 2021, 642 potential Olympic (PO) athletes were evaluated during the preparticipation Olympic screening. Of them, 384 were eventually selected to participate in the Games based on their athletic results. We analysed the cohort of Olympic participants, comparing those with and without a history of COVID-19 (100 and 284 athletes). Subsequently, we conducted a subanalysis of the entire group of athletes who recovered from the infection (120/642, 19%), 100 of whom were selected for Olympic Games participation and part of the total cohort of Olympic participants (384).

The standard evaluation for the preparticipation Olympic screening included personal and family history, physical examination, blood test (complete blood count, kidney and liver function, electrolytes), CV evaluation (standard 12-leads ECG, transthoracic echocardiography (TTE) and exercise stress test), pneumological, neurological, orthopaedic, ears-nose-throat and eye examinations.

In the case of SARS-CoV-2 infection, diagnosed by a positive PCR test, the FMSI RTP protocol was performed to screen for CV complications.[1]

At the time of the study, the RTP protocol included:

Blood tests

Complete blood count, lactic acid dehydrogenase, troponin, C reactive protein, D-dimer.

ECG

Recorded with the subject in a supine position during quiet respiration, at 25 mm/s and 10 mm/mV, using a Cardioline ClickECG (Cardioline, Italy). ECG patterns were analysed according to the international criteria for electrocardiographic interpretation in athletes.[2] In case of abnormalities, postinfection ECGs were compared with the previous ones (if available).

Transthoracic echocardiogram

Left and right ventricle (LV and RV) dimension, wall thickness, global and regional systolic function, indexes of diastolic function, as well as the presence of pericardial effusion were evaluated. Imaging interpretation was based on the international recommendation.[3 4]

Cardiopulmonary exercise test

Maximal, symptom-limited continuous ramp test using a cycle ergometer (MORTARA) connected with Quark cardiopulmonary exercise test (CPET) (COSMED). The following parameters were collected: resting heart rate (HR rest), resting systolic and diastolic blood pressure (SBP and DBP rest), maximal HR (HR max), maximal SBP and DBP (SBP and DBP max), maximal workload (Watt max), maximal ventilation, maximal oxygen uptake (VO2 max), ventilator efficiency slope (VE/VCO2 slope), oxygen pulse (VO2/HR) and peak respiratory exchange ratio. The peak VO2 was the highest VO2 during a 10 s interval obtained at the end of the exercise. The lactate threshold was determined using the V-slope and the ventilatory equivalent from O2 graphs. The ECG recording was in place for the entire duration, and any supraventricular or ventricular arrhythmias, ST/T changes or symptoms during the exercise were recorded.

Twenty-four-hour Holter ECG monitoring (12 leads)

Supraventricular and ventricular arrhythmias were investigated. The burden of premature ventricular contractions (PVCs) was arbitrarily classified as <50, 50–500 and >500 PVCs/24 hours. As previously defined, ventricular arrhythmias were classified as common or uncommon.[5] Newly diagnosed PVCs were those detected for the first time after the infection and not observed in previous evaluations.

Cardiac MR

Performed on clinical indication, cardiac MR (CMR) protocol included LV and RV volumes, ejection fraction assessment and tissue characterisation by late gadolinium enhancement and T1 and T2 Mapping. The myocarditis diagnosis was made per expert recommendations of CMR in non-ischaemic myocardial inflammation.[6]

The following information was also collected: the duration of infection (time from the first positive PCR test to the first negative) and the time of detraining (time from the negative PCR test to evaluation), the presence of symptoms related to the infection and any medications needed.

The following definitions were also used:

- SARS-CoV-2 CV involvement: myocarditis and pericarditis related to SARS-CoV-2 infection; complex arrhythmias not present before infection (for those athletes screened at the institute also before the pandemic) even without structural heart disease and with an elevated arrhythmic burden.
- Functional limitation: impaired and abnormal cardiorespiratory parameters at CPET.
- Medals: the total number of medals won by the athletes in every group (COVID-19+ and COVID-19−).
- Medal winners: every athlete that won a medal, even being part of a team sport.

All athletes included in this study were fully informed of the types and nature of the study and signed the consent form under Italian law and the institute's policy.

All clinical data assembled from the study population are maintained in an institutional database.

Equity, diversity and inclusion statement

Our research and author team included six women and seven men, senior and less-experienced investigators mainly from two disciplines (sports physicians and cardiologists). All members of the author group are from one country. The study population included both male and female Olympic athletes. The vast majority of the population is Caucasian; thus, the results of our study could not be generalised to other ethnicities. The lack of athletes of other ethnicities was considered a limitation of the study, as stated in the discussion section.

Patients and public involvement

Subjects from our population were not actively involved in the research process.

Table 1 Comparisons between Olympic participants with and without previous COVID-19

Parameters	Olympic participants N=384	Olympic participants COVID-19+ N=100	Olympic participants COVID-19– N=284	P value
Male sex, % (n)	53 (203)	59 (59)	51 (144)	0.153
Caucasian ethnicity, % (n)	94 (360)	97 (97)	93 (263)	0.118
Age, years	28±5	27±5	28±5	0.169
BSA, m^2	1.7±0.3	1.9±0.2	1.6±0.3	**<0.001**
BMI, kg/m^2	23±3	23±3.2	23±3	0.177
Diabetes, % (n)	0 (0)	0 (0)	0 (0)	–
Hypertension, % (n)	0.3 (1)	0 (0)	0.4 (1)	0.552
Dyslipidaemia, % (n)	1.6 (6)	0 (0)	2 (6)	0.143
Smoke, % (n)	0.8 (3)	1 (1)	0.7 (2)	0.773
Medal winners, % (n)	17 (66)	28 (28)	13 (38)	**0.001**
Olympic medals, % (n)	18 (72)	31 (31)	14 (41)	**0.004**
Gold, % (n)	4 (16)	6 (6)	3 (10)	0.239
Silver, % (n)	4 (17)	6 (6)	4 (11)	0.374
Bronze, % (n)	10 (39)	19 (19)	7 (20)	**0.001**

Bold values indicate statistical significance at the p<0.05 level.
BMI, body mass index; BSA, body surface area.

Research reporting checklist for a cohort study

The strengthening the reporting of observational studies in epidemiology (STROBE) cohort reporting guidelines were used to complete and provide the research reporting checklist.[7]

Statistical analysis

Statistical analysis was performed with Statistical Package for Social Sciences, V.23.0 (SPSS). Variables have been analysed to test normal distribution. Continuous variables were presented as mean±SD or median (25th–75th percentiles) when appropriate. Categorical variables were presented as numbers and percentages. Continuous variables were compared using a Student's t-test or the Mann-Whitney U test rank sum test, and categorical variables were compared by χ^2 test or Fisher's exact test, as appropriate. Differences were considered statistically significant when p≤0.05.

RESULTS

The total cohort of Olympic participants

Of the 642 PO athletes examined within the Olympic preparticipation screening, 384 were eventually selected to participate in the Olympic Games and represent the current study population. The demographics of this cohort of 384 Olympic athletes are reported in table 1. The study population was divided into two groups based on history of COVID-19 (COVID-19–284 subjects and COVID-19+100 subjects). There were no differences between the two groups except for body surface area. Of the 100 positive athletes participating in the 2020 Tokyo Olympic Games, 28 (28%) were medal winners, with 6 gold, 6 silver and 19 bronze medals. On the other hand, among athletes free from COVID-19, 38 (13%) became medal winners. COVID-19-positive Olympic participants did not obtain fewer medals when compared with negative ones (table 1). On the contrary, medal winners were significantly higher among athletes with previous COVID-19 (28% vs 13%, p 0.001, table 1 and figure 1). There were no significant differences in terms of sports disciplines between COVID-19+ and COVID-19– medal winners (respectively, skill: 7.1% (2/28) vs 7.9% (3/38); power 28.6% (8/28) vs 10.5% (4/38); mixed 34.2% (13/38) vs 25% (7/28) and endurance 39.3% (11/28) vs 47.4% (18/38); p=0.309). Among COVID-19+ medal winners, power and mixed athletes were more represented than in COVID-19– medal winners' group, but the difference was not statistically significant.

COVID-19 positive athletes

Of the total cohort of 642 PO athletes, 120 were affected by COVID-19, and 100 were selected for participation in the Games based on their athletic results and RTP evaluation. We performed a subanalysis of all the 120 athletes who recovered from COVID-19. The demographics, clinical and athletic characteristics of this population are reported in table 2. The mean age was 27±5 years; 74 (62%) were males and only 3 subjects (2%) were non-Caucasian; 101 (84%) athletes had been previously evaluated at our institution. Athletes were divided based on the European Society of Cardiology (ESC) sports classification: 42% competed in endurance disciplines, 28% in power, 27% in mixed and only 3% in skill. Regarding the characteristics of the infection,

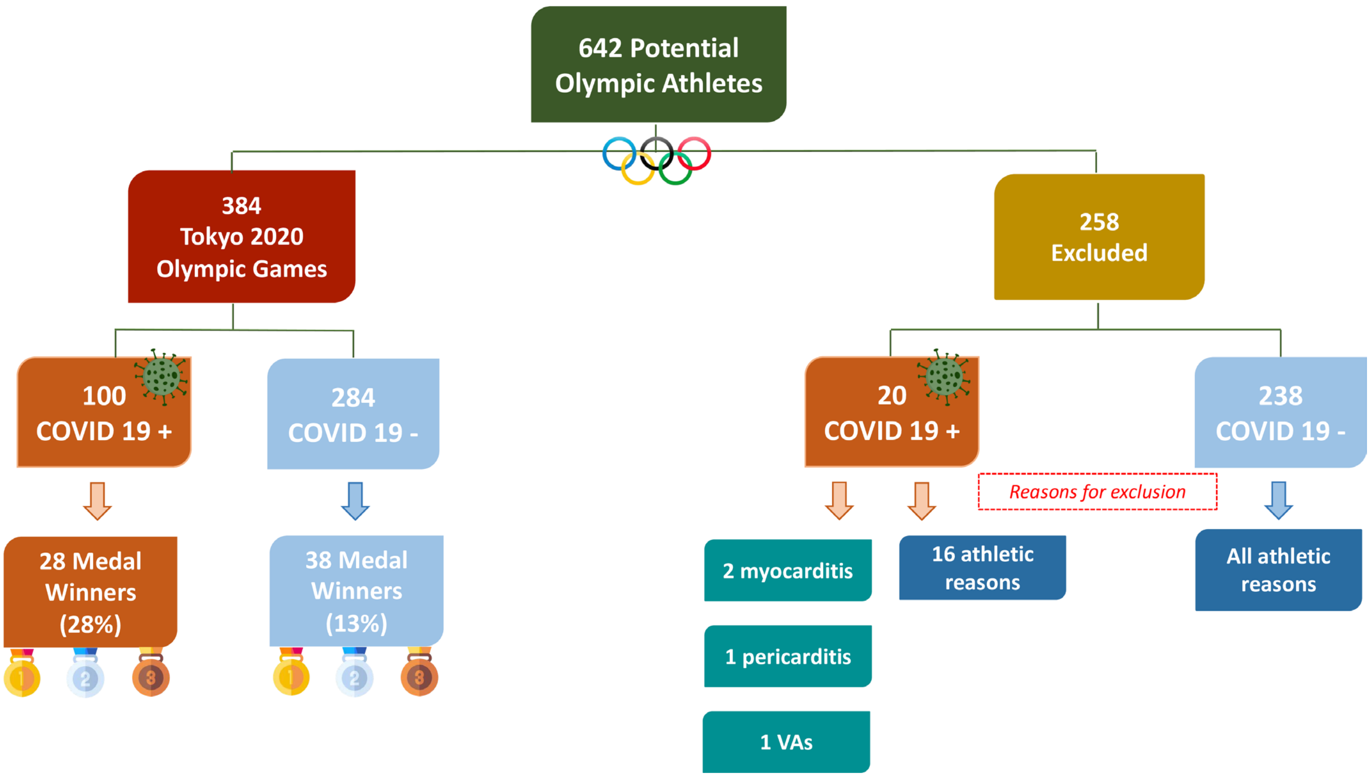

Figure 1 Flow chart of the Olympic athletes' evaluation and achievements at the Olympic Games: 642 PO athletes underwent pre-Olympic evaluation at our institute. Of these, 258 athletes were excluded from the Games: 238 did not have a history of COVID-19 and were all excluded due to athletic reasons. In comparison, 20 athletes had COVID-19, and 4 were excluded because of CV sequelae at R-T-P evaluation after COVID-19. Two athletes were diagnosed with myocarditis, one athlete had pericarditis and one athlete was found to have a heavy burden of ventricular arrhythmias. The other 16 were excluded due to athletic reasons, too. Three-hundred and eighty-four were selected for Olympic Games participation. One hundred had a history of previous COVID-19, and they won 28% of medals. Two-hundred and eighty-four athletes did not have the infection and won 13% of the medals. CV, cardiovascular; PO, potential Olympic; R-T-P, return to play; VAs, ventricular arrhythmias.

the course was asymptomatic in 19 (15.8%) athletes, 99 (82.5%) had mild symptoms and 2 (1.7%) had moderate disease, requiring therapy with antibiotics, steroids or heparin. The most common symptom was fever, followed by smell and taste loss, asthenia/myalgia, headache, cold and cough (table 2). Nine subjects (8%) had dyspnoea, and only 2 (1.7%) were diagnosed with pneumonia. The infection had a mean duration of 19±11 days, while the mean time of detraining was 30±13 days. At RTP protocol, abnormal ECG findings were detected in 12 athletes (10%), all previously evaluated at least once at our institute. In 7 cases were, new findings detected, namely ventricular repolarisation abnormalities. These seven athletes were asymptomatic, with no family history of sudden cardiac death or cardiomyopathies, had a normal echocardiogram, negative blood test including troponin, normal exercise stress test without arrhythmias and were additionally investigated with CMR that resulted negative. Therefore, there were no restrictions on Olympic Games participation.

CPET did not reveal any functional limitation, and normal cardiopulmonary parameters were found in all athletes, considering reference CPET parameters available for the general population (table 3). Uncommon ventricular arrhythmias were observed during CPET in 4 (3%) athletes.

At the 24-hour ECG monitoring, 56 (47%) athletes showed premature atrial contractions, of which 44% were less than 50 beats in 24 per hour. Forty-five athletes (37%) showed PVCs, of which 33% were less than 50 in 24 per hour and all were isolated. Only four athletes had uncommon ventricular arrhythmias at 24 hours ECG (also present at CPET) and were temporarily withdrawn from sports competitions due to the results of further investigations (TTE/CMR). Thirty-nine (33%) athletes underwent CMR based on clinical indication, with three exams being positive, two for myocarditis and one for pericardial effusion, respectively (figure 1). Specifically, two athletes were finally diagnosed with acute myocarditis, one with pericarditis and one had a negative imaging investigation but presented complex, repetitive and exercise-induced PVCs. In two cases, after 3 months, the CV evaluation demonstrated resolution, while in two cases, follow-up was prolonged for another 3 months due to the persistence of complex ventricular arrhythmias.

None of the athletes who resumed physical activity after a negative RTP evaluation experienced cardiopulmonary symptoms during exercise.

Table 2 General characteristics of the athletes with COVID-19 and comparisons between those participants versus those excluded at the Olympics

Parameters	Athletes N=120	Olympic participants N=100	Olympic excluded N=20	P value
Males, % (n)	62 (74)	59 (59)	75 (15)	0.179
Caucasian, % (n)	98 (117)	97 (97)	100 (20)	0.433
Age, years	27±5	27±5	28±4	0.345
BSA, m²	1.9±0.2	1.9±0.2	1.9±0.2	0.868
BMI, kg/m²	23±3	23.1±2.9	23.2±1.8	0.993
ESC sport category				
Skill, % (n)	3 (4)	3 (4)	0 (0)	0.331
Power, % (n)	28 (33)	29 (29)	20 (4)	
Mixed, % (n)	27 (32)	28 (28)	20 (4)	
Endurance, % (n)	42 (51)	39 (39)	60 (12)	
Cardiovascular risk factors				
Diabetes, % (n)	0 (0)	0 (0)	0 (0)	–
Hypertension, % (n)	0 (0)	0 (0)	0 (0)	–
Dyslipidaemia, % (n)	0 (0)	0 (0)	0 (0)	–
Smoke, % (n)	0.8 (1)	1 (1)	0 (0)	0.653
COVID-19				
Asymptomatic or pauci-symptomatic COVID-19 course, % (n)	15.8 (19)	15 (15)	4 (20)	0.603
Mild COVID-19 courses, % (n)	82.5 (99)	85 (85)	70 (14)	0.117
Moderate COVID-19 course, % (n)	1.7 (2)	0 (0)	10 (2)	**0.002**
Time of infection, days	19±1	20±11	16±7	0.212
Time of detraining, days	30±13	30±13	27±9	0.370
Therapy, % (n)	16 (19)	13 (13)	30 (6)	0.113
Fever, % (n)	48 (57)	44 (44)	65 (13)	0.209
Cold, % (n)	16 (19)	18 (18)	5 (1)	0.234
Headache, % (n)	21 (25)	20 (20)	25 (5)	0.734
Fatigue and myalgia, % (n)	38 (45)	36 (36)	45 (9)	0.639
Smell and taste loss, % (n)	43 (52)	45 (45)	35 (7)	0.543
Diarrhoea, % (n)	1.7 (2)	1 (1)	5 (1)	0.367
Cough, % (n)	10 (12)	9 (9)	15 (3)	0.597
Chest pain, % (n)	0 (0)	0 (0)	0 (0)	–
Palpitations, % (n)	0.8 (1)	0 (0)	5 (1)	0.067
Syncope, % (n)	0 (0)	0 (0)	0 (0)	–
Dyspnoea, % (n)	8 (9)	7 (7)	10 (2)	0.740
Pneumonia, % (n)	1.7 (2)	1 (1)	5 (1)	0.333
New ECG abnormalities, % (n)	6 (7)	6 (6)	5 (1)	0.862
New TTE pericardial effusion, % (n)	0.8 (1)	0 (0)	5 (1)	**0.025**
Abnormal troponin, % (n)	1.7 (2)	0 (0)	1 (2)	**0.001**
Olympic medals				
Total, % (n)	26 (31)	31 (31)	–	–
Gold, % (n)	5 (6)	6 (6)	–	–
Silver, % (n)	5 (6)	6 (6)	–	–
Bronze, % (n)	16 (19)	19 (19)	–	–

Continued

Table 2 Continued

Parameters	Athletes N=120	Olympic participants N=100	Olympic excluded N=20	P value

Bold values indicate statistical significance at the p<0.05 level.
BMI, body mass index; BSA, body surface area; ESC, European Society of Cardiology; TTE, transthoracic echocardiography.

Among the 120 athletes affected by COVID-19, 100 (83%) had been selected to participate in the 2020 Tokyo Olympic Games. No differences were found between those selected or not regarding the general clinical characteristics, except for moderate COVID-19 course, pericardial effusion, abnormal troponin values, number of total and uncommon PVCs during CPET and 24 hours Holter-ECG that were more frequent in athletes excluded from the Olympic Games (tables 2 and 3).

DISCUSSION

The COVID-19 pandemic has raised many issues regarding infection consequences in the athletic population. Special attention has been paid to the safety of competitive athletes in RTP after the infection. As a result, the FMSI established the RTP protocol to evaluate all competitive athletes who tested positive before resuming regular training.[1]

Furthermore, many studies have been conducted to evaluate the CV sequelae of the infection in athletes, with particular attention to myocarditis.[8–17] A preliminary study showed a worryingly high prevalence of myocarditis after COVID-19 in athletes (15%) based on CMR findings.[18] Later studies on wider cohorts reported a lower prevalence of myocarditis after COVID-19, ranging from 0 to 3% and varying with the screening strategy employed.[8–13 19] Specifically, the prevalence was lower when considering symptoms, ECG, troponin and echocardiogram and increased by adding the CMR to the diagnostic workup, depending on the protocol.[11 20] This evidence has raised concerns about the routine use of CMR in RTP because of the uncertain clinical meaning of isolated CMR findings in asymptomatic subjects.[20] Our results align with the most recent literature, showing a low prevalence of myocarditis (1.7%) in the entire cohort of positive athletes.

In addition, our study showed a non-negligible proportion of athletes presenting PVCs at CPET and 24-hour Holter-ECG monitoring. The majority of PVCs were isolated and common. Only four athletes (3%) presented

Table 3 CPET and 24-hour ECG monitoring

Parameters	Athletes N=120	Olympic participants N=100	Olympic excluded N=20	P value
CPET				
Peak HR, bpm	170±10	170±10	167±12	0.237
Peak SBP, mm Hg	171±19	171±17	168±24	0.522
Peak DBP, mm Hg	75±12	75±12	75±9	0.923
Peak VO2, mL/kg/min	42±9	41±9	42±9	0.582
VE/VCO2	27±4	27±4	27±4	0.694
RQ max, -	1.2±0.09	1.2±0.1	1.2±0.1	0.065
VO_2/HR, mL/beat	19±5	18±5	20±6	0.309
PVCs, % (n)	17 (20)	12 (12)	40 (8)	**0.002**
CPET uncommon PVCs, % (n)	3 (4)	0 (0)	20 (4)	**0.001**
24-hour ECG monitoring				
PACs, % (n)	47 (56)	46 (46)	50 (10)	0.743
PACs<50, % (n)	44 (53)	44(44)	45 (9)	0.934
PVCs, % (n)	37 (45)	34 (34)	55 (11)	0.077
PVCs<50, % (n)	33 (40)	30 (30)	50 (10)	0.083
Uncommon PVCs, % (n)	3 (4)	0 (0)	20 (4)	**0.001**

Bold values indicate statistical significance at the p<0.05 level.
CPET, cardiopulmonary exercise test; DBP, diastolic blood pressure; HR, heart rate; RQ max, respiratory quotient; PACs, premature atrial contractions; PVCs, premature ventricular contractions; SBP, systolic blood pressure; VE/VCO2, ventilatory efficiency; VO2, oxygen uptake; VO2/HR, oxygen pulse.

uncommon PVCs and were temporarily excluded from competition based on further investigations, with a final diagnosis reached in three cases (two acute myocarditis and one new pericardial effusion). In one case, the severity of ventricular arrhythmic burden required follow-up. Previous studies that included exercise stress tests in the RPT demonstrated a low prevalence of ventricular arrhythmias.[21–23] A recent report from the Italian Federation of Sports Medicine, which included 4100 subjects, showed 2.4% of ventricular arrhythmias at exercise tests or 24 hours of Holter-ECG monitoring and 0.12% of myocarditis.[24]

Moreover, these studies reported normal exercise capacity. All athletes in our cohort showed good performance at CPET. Furthermore, comparing the number of medals won between the athletes who tested positive and those who did not, the period of forced detraining due to the restriction imposed by the RTP protocol did not negatively affect the athlete's performance. A recent study investigating the performance of professional soccer players before and after COVID-19 showed that it took approximately 3 weeks for asymptomatic and 4–6 weeks for symptomatic players to return to the level of performance preceding the infection.[25] With a mean detraining period of 30±13 days, athletes with a previous infection who were allowed to resume physical activity and selected for the Olympics did not win fewer medals than COVID-19– subjects. In our cohort, there was a significant difference in medals between the two groups (COVID-19+ and COVID-19– athletes). Our data are not intended to prove a causative association between performance and COVID-19 nor to demonstrate that the previous infection could have improved physical performance. We want to highlight the results of previous COVID-19+ Olympic athletes, who, despite the infection and the prolonged period of forced inactivity, did not have an impaired performance and achievement in terms of medals compared with subjects that did not suffer from the infection.

Clinical implications

Most athletes have no CV sequelae and show a good functional capacity after COVID-19. Athletes at increased CV risk were identified during the RTP protocol primarily due to the presence of uncommon PVCs, which could be a red flag for CV involvement after COVID-19, prompting further investigation to ensure the safe resumption of training and competition.

The forced period of detraining of athletes allowed to resume physical activity did not negatively impact achievement in terms of medals.

Limitations of the study

Our study has some limits. First, it was a single-centre study, and the evaluation before and after COVID-19 was required only for a part of the cohort. Second, CMR was not performed in all athletes, thus excluding the possibility of evaluating the prevalence of eventual isolated enhancement or mapping abnormalities. Third, the vast majority of the population is Caucasian; thus, the results of our study could not be representative of subjects of other ethnicities. Finally, comparing CPET data before and after the infection was impossible because CPET was not performed routinely in the pre-COVID-19 era. At the same time, a comparison with previous editions of the Olympics is inappropriate as the cohort was vastly different. The number of athletes participating in more than one Olympic Games is smaller than the current cohort, and the test performed before the pandemic was an exercise test with a different stress protocol. Due to these considerations, performing a realistic analysis for comparison is not appropriate even considering the several possible confounders (different ages and amount of training in terms of years and hours, personal motivations…).

CONCLUSION

With a mean time of detraining of 30 days observed in our cohort, our study suggests that COVID-19 did not have any significant negative implication for sports performance in affected athletes who did not suffer from cardiac sequelae. Therefore, our experience suggests that a forced period of 1 month rest before resuming preparation for the Olympics did not negatively impact competition and medal achievement.

Contributors MRS: conception and design of the work, writing, reviewing and final approval of the manuscrip and is the guarantor of the overall content; SM: data acquisition, analysis and interpretation of data for the work, writing, reviewing and final approval of the manuscript; AG, MP, EG, GDG, RM, AS and BDG: data acquisition, reviewing and final approval of the manuscript; EL: acquisition, analysis and interpretation of data for the work, writing, reviewing and final approval of the manuscript; SP: acquisition, analysis and interpretation of data for the work, writing, reviewing and final approval of the manuscript; VM: conception and design of the work, data acquisition and interpretation, writing, reviewing and final approval of the manuscript; BDG and AP: data acquisition, writing, reviewing and final approval of the manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and the study design of the present investigation was evaluated and approved by the Review Board of the Institute of Sport Medicine and Science. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. Deidentified participant data are available on reasonable request from the corresponding author.

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