Cardiac Clearance of NCAA Athletes Following SARS-CoV-2 Infection in an Electrophysiology/ Cardiology Clinic at an Osteopathic Medical Center

It is important for clinicians to consider a thorough cardiac evaluation and activity modification following confirmed SARS-CoV-2 infection in college athletes.

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With over 4.6 million deaths and 225 million reported cases, the COVID-19 (SARS-CoV-2) pandemic continues to negatively affect the lives of many worldwide.[1] Athletes have been significantly affected, from cancellation of athletic events to unexpected cardiopulmonary complications despite optimal health. Cardiovascular function is paramount for athletes, and studies have demonstrated that severe cardiac complications can occur following SARS-CoV-2 infection, including myocarditis,[2,3] myocardial injury (elevated troponin),[4] heart failure, and arrhythmias.[5] Due to a paucity of clinical data, the prevalence of cardiac pathology in athletes following SARS-CoV-2 infection is unknown.

Three recent studies utilized cardiac magnetic resonance imaging (MRI) to evaluate subclinical pathology in competitive college athletes following asymptomatic to moderate COVID-19 illness confirmed by RT-PCR. Brito et al[6] showed that of 48 athletes, 27 (56.3%) had MRI changes indicating cardiac involvement with unknown clinical significance. Of these athletes, approximately 19% were completely asymptomatic.[6] Starekova et al[7] reported 2 out of 145 (1.4%) competitive student athletes having MRI findings consistent with myocarditis. Clark et al[8] reported myocarditis in 2 out of 59 athletes (3%), and pericarditis in 1 athlete.[8] These cardiac complications can potentially contribute to sudden cardiac death and significant morbidity. Cardiac screening post-COVID infection in NCAA athletes is important. This article aims to understand the current guidelines for cardiac evaluation and provide recommendations based on patients seen at the Long Island Heart Rhythm Center, an electrophysiology/cardiology practice at the New York Institute of Technology College of Osteopathic Medicine in Old Westbury, New York.

Methods

During the COVID-19 pandemic, many universities (including the New York Institute of Technology in Old Westbury, NY) postponed all collegiate athletics. Long Island University located in Brookville, NY (next to New York Institute of Technology) continued its athletics program, and three NCAA collegiate athletes (two gymnasts in September 2020 and one soccer player in August 2021) subsequently sought evaluation at the Long Island Heart Rhythm Center (LIHRC). These athletes were sent by their trainer/coach for cardiac clearance. The two gymnasts were unvaccinated for SARS-CoV-2 and had confirmed COVID-19 infection diagnoses in September 2020. The soccer player, who received the Moderna COVID-19 vaccine in July 2021, had confirmed COVID-19 infection in November 2020. Her internist ordered an echocardiogram and chest X-ray, which were both normal, leading to referral to the LIHRC. All of these athletes were evaluated with a cardiac history and physical examination including an ECG, and a transthoracic echocardiogram was ordered. Additional tests were ordered for the soccer player to evaluate long-haul COVID-19 symptoms, myocarditis, and pulmonary embolism, including a repeat echocardiogram, cardiac MRI, computed tomography angiography (CTA), pulmonary consultation, and real-time telemetry recording. The review of these patients' medical records was approved by the New York Institute of Technology Institutional Review Board under the "Diagnostic and Therapeutic Outcomes from the Long Island Heart Rhythm Center" registry study.

Results

The gymnasts both experienced an asymptomatic infection with SARS-CoV-2 and lacked any significant findings of cardiac pathology. The soccer player experienced anosmia and hypogeusia during COVID-19 infection, and following vaccination in July 2021, experienced shortness of breath and chest pain when exercising and decreased exercise capacity. From the standpoint of the history and physical examination, both gymnasts were in pristine cardiopulmonary health. ECG findings showed a normal RSR' variant pattern in lead V1 in one athlete, and normal sinus rhythm in the other. Although echocardiography was ordered, neither gymnast sought this evaluation through our clinic. The soccer player had an unremarkable physical exam and normal ECG except for RSR' pattern in lead V1. Results are pending from her repeat echocardiogram, cardiac MRI, CTA, pulmonary consultation, and real-time telemetry recording. Table 1 shows the clinical characteristics of the three NCAA athletes we screened post-COVID infection.

Discussion

Importance of ECG, Echocardiogram, and Other Tests

The ECG and echocardiogram are useful for screening following COVID-19. Both are noninvasive,

Table 1. Results of cardiac evaluation in three NCAA athletes following SARS-CoV-2 infection.
NSR = normal sinus rhythm; DOE = dyspnea upon exertion.

	Gymnast A	Gymnast B	Soccer Player
COVID-19 Symptoms	Asymptomatic	Asymptomatic	Anosmia, hypogeusia
Symptoms	Asymptomatic	Asymptomatic	DOE, chest pain
ECG	RSR' in V1	NSR	RSR' in V1
Echocardiogram	Ordered	Ordered	Ordered
Cardiac MRI/CTA	Not ordered	Not ordered	Ordered

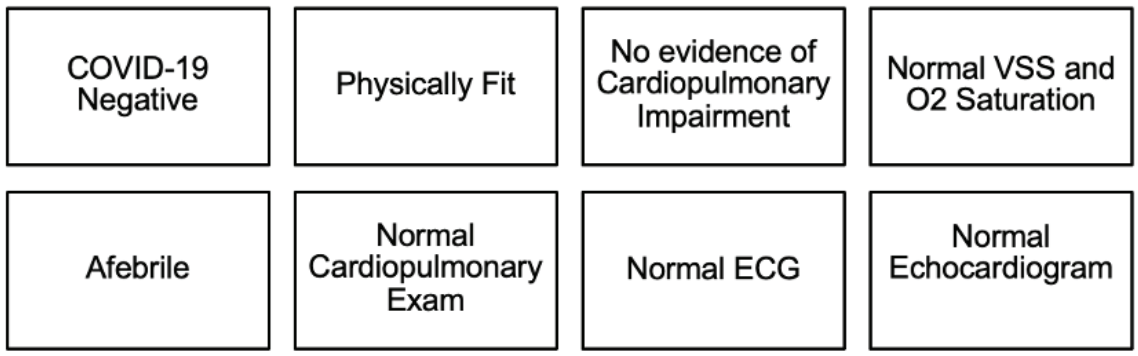

Figure 1. Components of the cardiac evaluation in NCAA athletes following SARS-CoV-2 infection. The Long Island Heart Rhythm Center evaluation for cardiac issues in two NCAA gymnasts following SARS-CoV-2 infection. VSS = vital signs; O2 saturation = oxygen saturation.

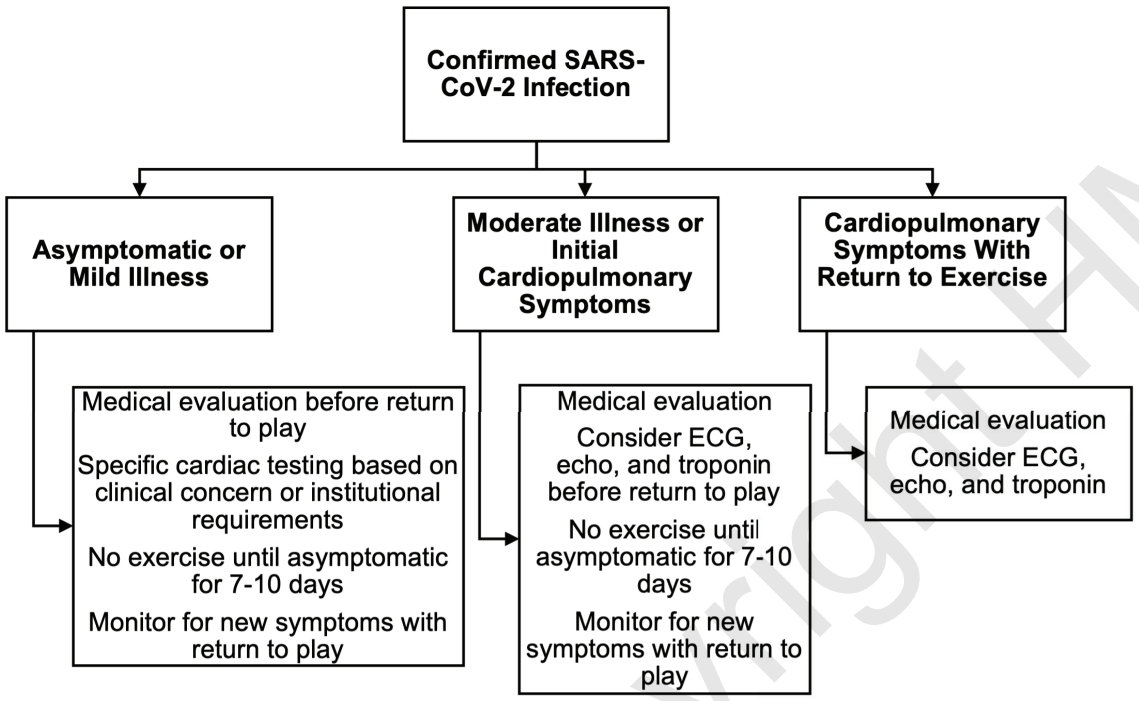

Figure 2. Cardiac considerations for college student athletes during the COVID-19 pandemic. Recommendations for cardiac testing from an expert panel from the American College of Cardiology and American Medical Society for Sports Medicine. The recommendations are based on limited evidence. If the cardiac testing results are abnormal, obtain a cardiology consultation and consider cardiac MRI before return to play. *Adapted from Phelan et al.*[8]

relatively low cost, and may potentially detect cardiac impairment. For example, in the setting of asymptomatic myocarditis, the ECG may show changes (such as PR, QRS, and QT prolongation), AV block, bundle branch block, and ST/T wave changes. However, these findings have a low sensitivity and unknown specificity considering that many athletes have benign changes that are similar to those of myocarditis.[9] The cardiac troponin level may also indicate myocardial injury, but it was not used for our athletes.[4] Other imaging modalities such as cardiac magnetic resonance imaging (MRI) may also be useful in detecting myocarditis.[10] In this study, an MRI was only ordered on the soccer player (still pending), along with a CTA, pulmonary consultation, and other cardiac tests, due to significant cardiopulmonary impairment during athletic training.

New York Institute of Technology and American College of Cardiology Guidelines

Our recommendations for cardiac screening of NCAA athletes following COVID-19 infection include a comprehensive history and physical examination, serving to guide clinicians on the use of further cardiac testing. Cardiac testing is indicated in the setting of clinical concern, eg, persistent cardiopulmonary symptoms at rest or upon exertion, university requirements, and previous mild to severe COVID-19 illness. These cardiac tests should include a 12-lead electrocardiogram (ECG) and echocardiogram (Figure 1). Tests of cardiac troponin levels may also be utilized and demonstrate myocardial injury. Additional clinical tests including cardiac MRI, CTA, pulmonary consultation, and cardiac monitoring should be considered on an individual basis if cardiopulmonary symptoms are detected and/or persist, as occurred in our most recent athlete. Additionally, we advise against returning to NCAA athletic participation should the athlete have active cardiopulmonary symptoms and/or cardiac impairment. This same cardiac screening protocol is also endorsed by the American College of Cardiology (Figure 2) and Phelan et al.[10,11] Recently, the American Academy of Pediatrics posted similar guidelines; however, it was suggested that adolescent athletes be evaluated at least via phone or telemedicine visit after SARS-CoV-2 infection. These guidelines also recommend an in-person visit including physical exam and cardiac testing for those athletes with significant cardiopulmonary symptoms or with previous moderate to severe COVID-19 symptoms.[12] Therefore, the cardiac screening guidelines differ slightly among organizations and continue to evolve. More evidence is required to develop an optimal approach. This is due to small study samples and a lack of multicenter trials, which limit the understanding of the prevalence of cardiac pathology as well as the validity of cardiac testing in this population. Consequently, future evidence may further highlight the importance of cardiac evaluation even in asymptomatic athletes.

Return to Play Following COVID-19

Following diagnosis of symptomatic COVID-19 illness in college athletes, clinicians must also consider the importance of activity modification. The competitive athlete must rest for 10 days after the onset of symptoms, then be asymptomatic for 7 days after that period, termed stage 1. They may perform activities of daily living and walking in this period. Following this, athletes may progress through activity stages with increased frequency and length overtime depending on their symptoms as closely monitored by the clinician. In stage 2, the athlete may participate in light aerobic activities including light jogging and stationary cycling for at most 15 minutes. Stage 3 includes up to 45 minutes of more challenging aerobics such as running and resistance training. After stage 3, athletes can perform the same activities with increased intensity and duration for up to 1 hour. In stage 5, athletes can resume normal training. The athlete should remain in stages 2-4 for at least 1-2 days each. Should athletes become symptomatic, it is important that they be monitored and asymptomatic with rest for at least 24 hours. Subsequently, the athlete can return to activities starting in the previous stage.[13] Athletes with findings of cardiac complications such as myocarditis should be withdrawn from sports and managed the same way as athletes without COVID-19. Our third symptomatic athlete, more than 6 months after her original diagnosis of COVID-19, has not been cleared to participate in practice/NCAA competition.

Conclusion

It is important for clinicians to consider a thorough cardiac evaluation and activity modification

following confirmed SARS-CoV-2 infection in college athletes. Asymptomatic illness may not necessitate extensive cardiac testing; however, such testing is important for athletes with previous mild to severe COVID-19 symptoms or ongoing clinical concern (long-haul COVID-19 symptoms) to exclude subclinical pathologies or other cardiac diseases. ■

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