Return to Play for Athletes After Coronavirus Disease 2019 Infection

As the coronavirus disease 2019 (COVID-19) pandemic began to evolve, case reports suggested that a clinical syndrome consistent with inflammatory myocarditis could occur as the underlying mechanism for the oft-seen elevations in biomarkers of myocardial injury and stress.[1] However, as data have progressed, a picture has emerged from autopsy studies of myocardial involvement with viral infection and a cytokine response, but less often inflammatory cell infiltrate consistent with myocarditis.[2] In July, a high-profile report[3] emerged from Germany showing that more than 2 months after COVID-19 diagnosis, in a group of patients who had clinically recovered after a broad spectrum of disease severity (ranging from asymptomatic to severe illness with intubation), cardiac magnetic resonance (CMR) imaging and biomarker findings in the recovery phase were consistent with active ongoing myocardial involvement and inflammation in 60% of patients.

As the initial pandemic wave in the US began its first ebb, among the many aspects of everyday life that began to slowly move back toward normalcy were sports and athletics. High school, intercollegiate, and professional sports leagues had all come to a halt in the spring, disrupting many young lives and much fandom. However, concern about cardiac involvement became a vanguard rationale for potentially canceling entire league or conference seasons,[4] to some degree even more than broader concerns regarding the challenge of social distancing and other public health antivirus measures.

In May, members of the American College of Cardiology's Sports and Exercise Cardiology Council published a report[5] in *JAMA Cardiology* with recommendations for athletes who had tested positive for COVID-19 regarding return to play. The recommendations were based on their experiences and informed by prior American Heart Association and American College of Cardiology eligibility and disqualification recommendations for athletes in competitive sports who have cardiovascular abnormalities, specifically those involving myocarditis.[6] More recently, a report[7] on 26 athletes at the elite collegiate level who had tested positive for COVID-19, most of whom had been asymptomatic, showed that following quarantine, 15% had CMR evidence of active myocardial inflammation despite normal cardiac structure and function by echocardiography, as well as normal serum levels of troponin.

All of these findings raise the stakes on trying to find a safe path forward for athletes at all levels who have tested positive for COVID-19. Hardly a day goes by without reports of clusters of athletes with positive COVID-19 test results on collegiate or professional teams or athletes with high profiles who have positive test results and move to quarantine. Physicians, trainers, coaches, league officials, and those responsible for the welfare of athletes, as well as the athletes and their families themselves, have been faced with substantial uncertainty about the safety of returning to training and competition.

In this issue of *JAMA Cardiology*,[8] updated guidance for return to play is provided by a group of sports cardiologists, some of whom authored the prior report.[5] The recommendations exemplify the major challenge facing these colleagues as they try to sculpt guidance from scant information and data. Expert opinion is far better than no opinion, but

the recommendations call into stark light the usual conundrums involved in screening for low-prevalence findings. Should we be more sensitive by doing more extensive testing to find the small number who have CMR evidence of myocarditis? If so, we will identify some athletes with isolated CMR findings that may not be clinically relevant but may lead to substantial anxiety and potential disqualification. Alternatively, should we be more specific but risk missing the occasional case of ongoing myocardial inflammation with attendant risk of sudden death on return to play? These challenges illustrate the need to ensure we are constantly collecting data to inform decisions and update recommendations.

Going forward, it is likely that CMR imaging will play an important role in decision-making. Cardiac magnetic resonance imaging allows for the identification of both myocardial edema via T2-based markers as well as myocardial injury via T1-based markers. While the identification of either of these markers in isolation is nonspecific, the updated Lake Louise criteria promote the idea that identification of both edema and injury by CMR provides a highly specific diagnosis of acute myocardial inflammation.[9,10] It is notable that despite the benefits of CMR in detecting myocardial injury after COVID-19, CMR was not included as part of first-line testing for most athletes in the Kim et al[8] recommendations.

In this regard, the guidance by Kim et al[8] differs from the recently published guide for return to play in the UK,[11] which advocates a more liberal inclusion of CMR. In contrast to Kim et al,[8] who recommend no cardiovascular screening in most athletes who recover from COVID-19 with mild symptoms, the UK pathway recommends obtaining routine screening electrocardiogram and echocardiogram. In addition, for

athletes with prior cardiovascular symptoms, the UK group recommends CMR as part of initial testing, differing from those of Kim et al,[8] in which CMR is recommended only if abnormalities are detected in other cardiovascular tests.

However, Kim et al[8] appropriately raise concern regarding the potential presence of isolated CMR abnormalities, which may lead to potentially inappropriate activity restrictions and downstream testing. For example, isolated abnormalities in T2-weighted images, late gadolinium enhancement, or increased T1 values encompassed most CMR findings in 1 study,[7] in which they were present in almost one-third of athletes who were asymptomatic. The absence of control populations of young athletes with CMR makes it unclear if these abnormalities are indeed associated with COVID-19 or represent markers for increased risk. It is likely that for these reasons, the current recommendations do not advocate broader use of CMR, potentially limiting sensitivity of detecting individuals at risk, but with likely improved specificity and decreased burden of unwarranted athletic restriction. Further research on CMR in those recovered from COVID-19 should be a research priority to inform future recommendations for athletes and the general population who have recovered from COVID-19.

Not to be lost in the discussion about thresholds for testing are the views of the many other stakeholders here, the athletes, their families, and those responsible for their welfare. Since early March 2020, performance and medical professionals who support athletes at various levels have attempted to construct training environments, procedures, and practices based on emerging yet inconsistent science on the ramifications of contracting COVID-19. The short-term and long-term effects associated with cardiac injury and function have

been an unknown, confounding variable in the planning and application of training and competition stressors. A consensus statement on cardiovascular pathology and return to play will be welcomed to guide the path forward for those who support and provide care for athletes.

Although there remains uncertainty, it is promising that early experiences have observed that nearly all athletes who recover from mild COVID-19 infection do not develop significant cardiovascular pathology. This appears to drive the current recommendations on nonstratification in athletes with asymptomatic and mildly symptomatic COVID-19 after US Centers for Disease Control and Prevention–recommended isolation. This will be welcome news for front offices, administrators, and parents who are currently managing compromised budgets and would like to safely reduce diagnostic medical costs during this pandemic. Additionally, for athletes and sport coaches who seek an expedited normalization back to training and competition, these will be comforting guidelines. Whether the UK approach advocating broader testing and stratification is more correct or prudent will only be clear with more time and data.

For clinicians and practitioners, these proposed guidelines place an increased importance on monitoring for cardiovascular symptoms during the gradual return to sporting activities. In the current landscape, with objective workload data readily accessible in many professional and collegiate sporting environments that have access to wearable devices (monitoring heart rate and stress loads throughout training), the graded escalation with monitoring will be relatively routine. There is specific concern for athletes who are COVID-19 positive and younger than 15 years, because there is traditionally a lack of medical and performance resources to monitor safe return to play in

this population. This burden will fall on parents and coaches, who may lack requisite understanding of symptom onset and necessary follow-up. Compressed preseasons and scenarios of return to play within a competitive season after infection will also be of concern. It will be of great importance for athletic trainers, strength and conditioning coaches, and sport coaches to coordinate in a way that allows for ongoing and prudent risk assessment, emergency action planning, and subsequent contingency plans in the event cardiovascular stratification is warranted because of symptom development after infection and recovery. For athletes who experience moderate or severe symptoms, stratification will allow for a better foundation for shared decision-making and the assumption of risks for the athlete. It should be anticipated that some athletes with mild and asymptomatic COVID-19 and their families will seek clinical risk stratification despite these guidelines, and clinicians will need to be prepared to incorporate testing results into their recommendations.

The proposed decision trees for oversight of the high-stakes activities of return to play will be of great clinical value to medical and performance professionals who have sought direction the last seven months. As pointed out by Kim et al,[8] knowledge gaps remain and call out for coordinated acquisition of data, perhaps funded by those who benefit from the endeavors of the athletes, such as professional sports leagues and the National Collegiate Athletic Association. However, as we move forward, it is clear that clinicians and practitioners must remain vigilant in their care despite even mild severity of initial symptom presentation. It is critical that measures to reduce the prevalence of COVID-19 infection are in place, so that athletes ultimately do not have to engage in this process as the world returns to sports.

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