

## Case Report

# Don't MISS MIS-C: A Division-1 Athlete with a Possible Deadly Post-COVID Complication

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**Abstract**

This case is about an 18-year-old African-American male, who is a division-I college football offensive lineman, with a history of asthma and obesity who presented to the emergency department (ED) with fever and myalgias. The patient tested positive for COVID-19 approximately a month before during a routine screening and was asymptomatic at the time. The patient presented to the ED with 2 days of fever, headache, myalgias, and generalized weakness. His labs showed he had markedly elevated inflammatory markers, a transaminitis, and thrombocytopenia. He also had new T-wave inversions on his ECG. He was treated with prophylactic Lovenox due to his elevated D-dimer and risk for VTE. His MIS-C was treated with IVIG 1 g/kg (max 80 g). His inflammatory markers decreased, his symptoms resolved and after a few days he was discharged from the hospital on ASA 81mg. He then did a progressive exercise program which included strict cardiac monitoring which he completed without issue. He returned to full football activity 4 weeks after his initial diagnosis. This is the first known case of MIS-C in an elite college athlete. It is important to consider MIS-C in our younger athletes as a consequence of Covid-19 which may lead to significant risk factors for their playing future. This disease process can be deadly and, in most cases, need admission to an intensive care unit. This case highlights the importance of early diagnosis and treatment, as well as the various cardiac diagnostic modalities needed to assist with the return-to-play process.

**ABBREVIATIONS**

MIS-C: Multi-inflammatory Syndrome in Children; ED: Emergency Department

**INTRODUCTION**

Multisystem inflammatory syndrome in children (MIS-C) is a condition where all organs can become inflamed. The cause is unknown, and it affects 2 in 100,000 persons with a predilection for black, Hispanic, or South Asian children. In May of 2020, the United States Centers for Disease Control (CDC) issued national guidance on an emerging phenomenon in the context of the Coronavirus Disease 2019 (Covid-19) pandemic seen in the pediatric population, named Multisystem Inflammatory Syndrome in Children (MIS-C) [1]. These cases were defined as individuals being under 21 years old, having fever, laboratory evidence of inflammation, and evidence of clinically severe illness requiring hospitalization with recent or concomitant Covid-19 infection or exposure. Children meeting these criteria were often found Kawasaki-like illnesses with varying degrees of multi-system organ dysfunction.

There has been much conversation in both national and international media about athletes' exposure to Covid-19 and its impact on sport at a variety of levels. In this article, we discuss a case of MIS-C in an American Football player at the Division 1 collegiate level. We aim to highlight the athlete's clinical course, critical diagnostic and therapeutic choices, and the return-to-play protocol that was followed.

**CASE PRESENTATION**

The patient was an 18-year-old male with a history of well-controlled asthma and obesity who is a Division 1 American football offensive lineman. On routine screening at the start of preseason training four weeks prior to presentation, the patient had asymptotically tested positive for Covid-19 via nasopharyngeal viral PCR. He had isolated per university protocols, still without any symptoms, and returned to practice. Four weeks after his initial positive test, the patient presented to the emergency department (ED) with two days of persistent fevers with a maximum temperature of 40°C (104°F), generalized myalgias, sore throat, and malaise. He denied any cardiopulmonary symptoms including chest pain or shortness of breath.

On initial physical examination, he was well-appearing with an oxygen saturation of 98% on room air, blood pressure of 116/90, heart rate of 91, and a respiratory rate of 16. He had some mild posterior oropharyngeal erythema without exudate, and a small, palpable anterior cervical lymph node that was mildly tender to palpation. His lungs were clear to auscultation and no cardiac murmur was appreciated. During the examination, the patient did develop some rigors.

The patient, like all other football athletes at this institution, had obtained a screening EKG on arrival to campus. The repeat EKG during this ED encounter showed a newly inverted T-wave in lead III and a flattened T-wave in aVF. Troponin evaluation using high-sensitivity Troponin T was negative. Other laboratory

workup was notable for elevated CRP to 12.05 mg/dL, elevated ferritin to 613 ng/mL, white blood cell differential with 27% bands and only 2% lymphocytes, elevated D-Dimer to 1,952 ng/mL. He also had a slightly elevated INR of 1.3. Platelet count was slightly decreased at 138,000.

The patient had another fever in the emergency department which was treated with acetaminophen. At this time, based on the recent positive Covid test, fever, and abnormal laboratory assessment, the patient was admitted as an inpatient for further evaluation and treatment of MIS-C. On admission, the patient also developed some non-bloody diarrhea. The patient had an echocardiogram, which showed a slightly dilated left ventricle with preserved systolic and diastolic function. No regional wall motion abnormalities were noted. A Cardiac MRI was then performed which was normal but did not fully evaluate the coronary arteries, so a Cardiac CT angiogram was done as an outpatient and showed normal coronary arteries.

The patient was started on 80g of intravenous immunoglobulin (IVIg). He was prophylactically started on low molecular weight heparin as an inpatient due to concern for thromboembolism in the setting of elevated D-Dimer and the known risk of thrombosis associated with Covid infection. He remained hospitalized for two days and was discharged on day 3 with improving inflammatory markers and improving symptoms with instructions to take 81mg ASA daily. After his normal outpatient Cardiac CT angiogram, ASA was stopped as the patient remained asymptomatic.

Return to play precautions were considered utilizing the American College of Cardiology's recommendations for athletes with diagnosed coronavirus infection and/or diagnosed myocarditis [2]. Based on this athlete's negative CTA and cardiac MRI, he was determined to not have myocarditis and was deemed ready to begin Stage 2 of his home institution's return to play protocol, shown below, approximately 18 days after his initial

diagnosis of MIS-C (Figure 1). He tolerated this progression well and successfully returned to full activity 7 days later.

## DISCUSSION

Various case reports have been written about MIS-C, but little is known about its impact on athletes and what kinds of return-to-play protocol should be utilized to ensure athlete safety. This case highlights the importance of thorough cardiac testing to successfully clear an athlete for return to play. Multiple prior case series have shown the incidence of myocarditis in patients with MIS-C to be 50% or greater [3,4]. Another case series of 186 MIS-C patients showed that: 80% received intensive care, 20% received mechanical ventilation, 48% received vasoactive support, 8% had Coronary-artery aneurysms and 2% died [5]. To miss this diagnosis in a young, otherwise healthy athlete could have devastating consequences.

In addition, it was crucial that this rare diagnosis was made and that treatment was initiated promptly in accordance with what were relatively new but largely consensus guidelines at the time [6]. Early recognition and treatment of MIS-C appears to be correlated with long-term avoidance of cardiac dysfunction, an obviously important end result for an athlete at any level, let alone in Division 1 athletics. In one study, 33% of patients had a decreased ejection fraction of <35%, 80% required inotropic support and 28% needed to be placed on extracorporeal membrane oxygenation [7].

This patient received multiple EKGs, a troponin evaluation, cardiac echocardiogram, cardiac MRI, and a coronary CTA. While this may seem like an overly extensive workup, a different systematic review of MIS-C cases showed a 23% incidence of coronary abnormalities [8]. Findings like these in an athlete would certainly make return-to-play a more prolonged process with a different risk stratification than that taken in our patient.

COVID Graduated Return to Sport Progression							
	Stage 1	Stage 2	Stage 3a	Stage 3b	Stage 4	Stage 5	Stage 6
Minimum Days	10	2 days	1 day	1 day	2 days	17 days post-diagnosis	Return to full practice and competition
Activity Description	Required isolation period	Light activity	Increase training frequency	Duration of training increases	Intensity of training increases	Resume normal training and lifting progression	
Exercise Allowed	Case by case basis - see Duke Athletic Medicine COVID exercise guideline	Walking, light jogging, stationary cycle, no resistance training	Simple movement activities and drills, resistance training	Progression to more complex training activities	Sport-specific drills, preseason fitness tests (if deemed appropriate)	Participate full practice	
% HRmax (%HR should be achieved during session but does not need to be maintained)	N/A	<70%	<80%	<80%	<90%	Monitor	
Duration	10 days minimum	≤15 minutes	≤30 minutes	≤45 minutes	≤60 mins	Normal training	
Objective	Allow recovery, protect cardiorespiratory system	Increase heart rate	Increase load gradually, manage post viral fatigue	Exercise coordination and skills	Restore confidence and assess functional skills	Resume training	

Figure 1 COVID Return to Play Protocol.

As we continue to navigate and learn from this global pandemic, and in particular how to advise athletes who may contract this disease, it is important to consider MIS-C in our younger athletes as a consequence of Covid-19 which may lead to significant risk factors for their playing future. We do not know the negative outcomes that could have occurred in this athlete if it was not for the quick action and initiation of treatment by the athletic training staff and emergency department. This case is an example of a case of MIS-C in a high-level athlete and highlights the importance of early diagnosis and treatment, as well as the various cardiac diagnostic modalities needed to assist with the return-to-play process.

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