DELAWARE ACADEMY OF FAMILY PHYSICIANS

Update on COVID and DIAA Return to Sports / Cardiac Clearance

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2023 SPORTS MEDICINE SYMPOSIUM

DISCLOSURE

- No Disclosures related to this presentation

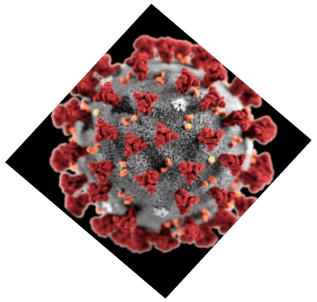
LEARNING OBJECTIVES

At the conclusion of this presentation the learner will be able to:

1. To provide guidance about individual return to play or strenuous activity following infection with COVID-19

2. To learn to recognize concerns for cardiac involvement with or after COVID-19 infections

Introduction

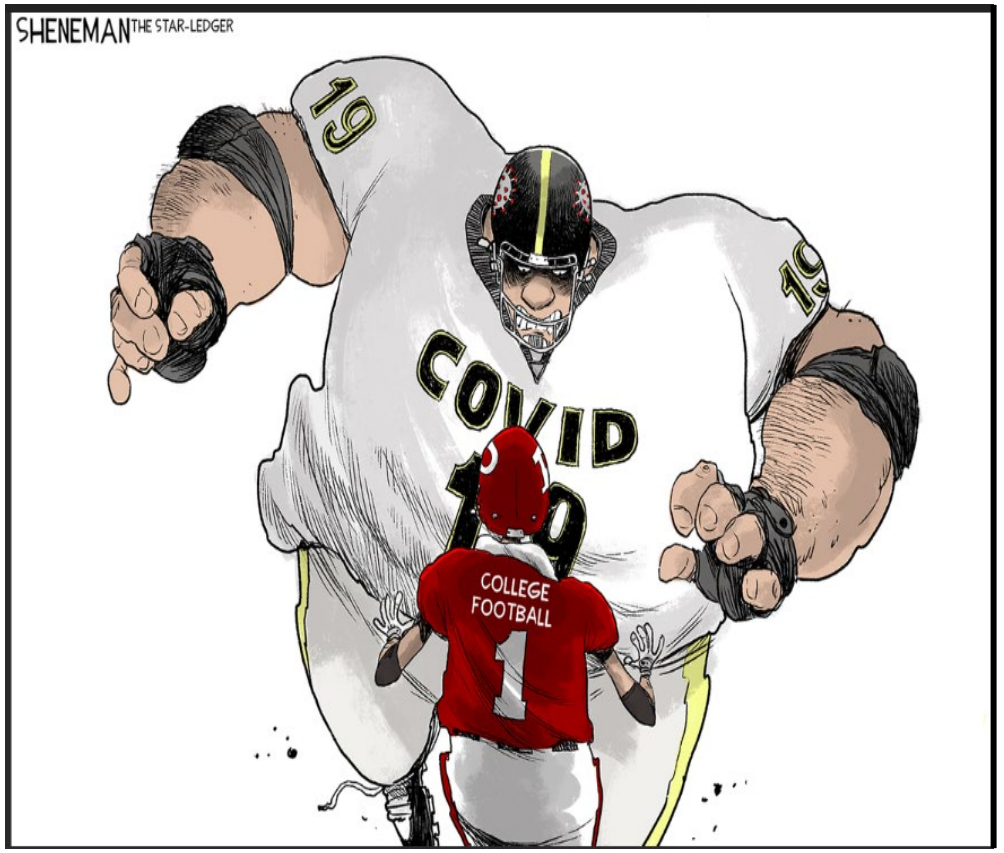


- The COVID-19 pandemic had an unprecedented impact on physical activity and sports, affecting athletes at all levels of participation
- Social distancing were put in place in 2020: sports participation declined exponentially among children of all ages
- Concerns were raised about effects of COVID-19 on the heart, algorithms were developed restricting sports participation after COVID-19 till they were cleared by their primary care physician or by a cardiologist
- As the pandemic progressed, through population data and research studies, the actual effects of COVID-19 on the heart and risks of exercise and sports participation were better understood and some of the exercise restrictions were relaxed

Global Impact of COVID-19 on Sports

Social Restrictions caused detraining:

- Retrospective study of Spanish students enrolled in 16 universities, 13,754 valid survey responses, described reduced moderate (-29.5%) and vigorous (-18.3%) physical activity during confinement and increased sedentary time (+52.7%)
- Multiple small, observational cohort studies reported comparable declines in fitness among adolescents



Understanding the Risks - Myocarditis

JAMA Cardiology | Original Investigation

Prevalence of Clinical and Subclinical Myocarditis in Competitive Athletes With Recent SARS-CoV-2 Infection
Results From the Big Ten COVID-19 Cardiac Registry

Curt J. Daniels, MD; Saurabh Rajpal, MBBS, MD; Joel T. Greenshields, MS; Geoffrey L. Rosenthal, MD; Eugene H. Chung, MD; Michael Terrin, MD; Jean Jeudy, MD; Scott E. Mattson, DO; Ian H. Law, MD; James Borchers, MD; Richard Kovacs, MD; Jeffrey Kovan, DO; Sami F. Rifat, MD; Jennifer Albrecht, PhD; Ana I. Bento, PhD; Lonnie Albers, MD; David Bernhardt, MD; Carly Day, MD; Suzanne Hecht, MD; Andrew Hipskind, MD; Jeffrey Mjaanes, MD; David Olson, MD; Yvette L. Rooks, MD; Emily C. Somers, PhD; Matthew S. Tong, DO; Jeffrey Wisinski, DO; Jason Womack, MD; Carrie Esopenko, PhD; Christopher J. Kratochvil, MD; Lawrence D. Rink, MD; for the Big Ten COVID-19 Cardiac Registry Investigators

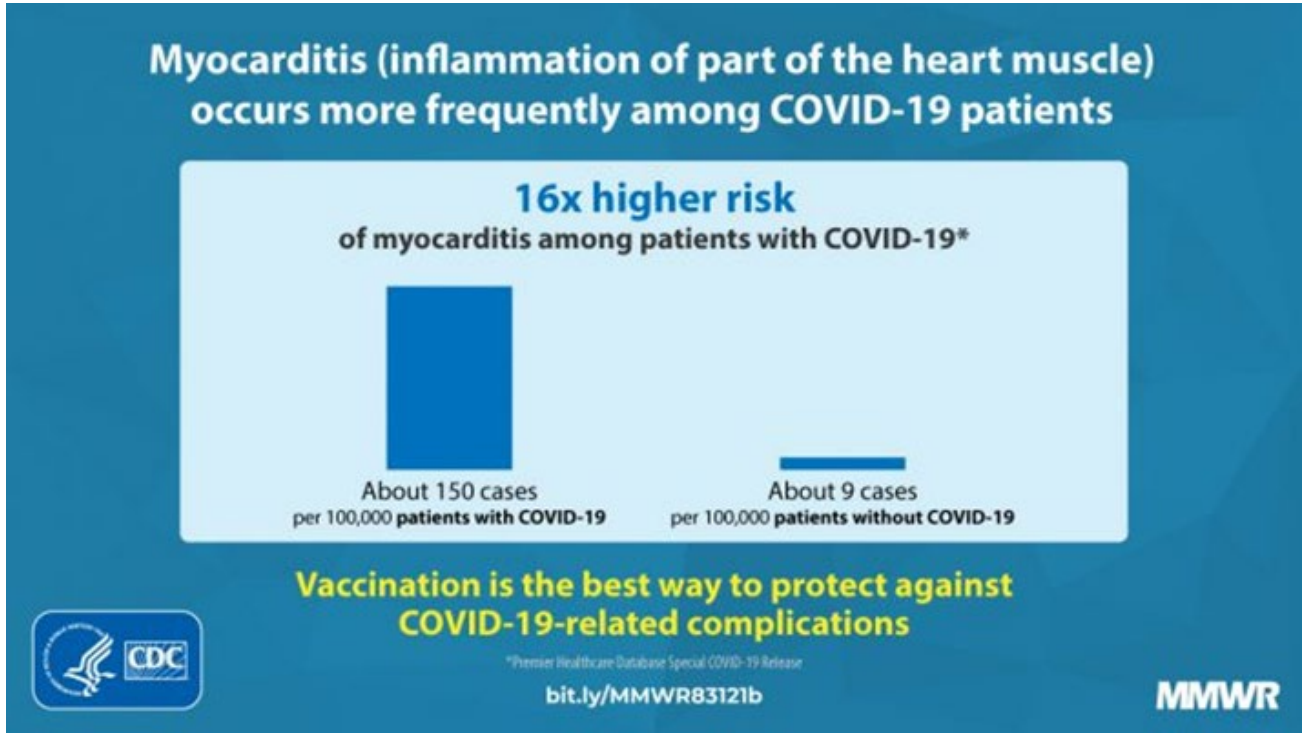
Myocarditis - can be exacerbated by exercise during recovery- can cause sudden cardiac arrest

Murine models show exercise can worsen myocardial damage and increase mortality risk following myocarditis

- Representing 13 universities: Cardiovascular testing in 1597 athletes (964 men [60.4%])
- 37 (27 men) diagnosed with COVID-19 myocarditis (2.3%): 9 clinical, 28 subclinical
- If cardiac testing was based on cardiac symptoms alone, only 5 athletes would have been detected (detected prevalence, 0.31%)
- Follow-up CMR imaging performed in 27 (73.0%) demonstrated resolution of T2 elevation in all (100%) and late gadolinium enhancement in 11 (40.7%)

Incidence of Myocarditis with COVID

March 2020–January 2021, risk for myocarditis 0.146% among patients diagnosed with COVID-19 during an inpatient or hospital-based outpatient encounter and 0.009% among patients who were not diagnosed with COVID-19



Boehmer TK, MMWR Morb Mortal Wkly Rep 2021;70:1228–1232.

Incidence of Myocarditis with COVID

- Observational study - 789 professional athletes who tested + for COVID-19: 5 (0.6 %) demonstrated evidence of inflammatory heart disease (myocarditis or pericarditis) on CMR. All 5 had > Mild S/S *(Martinez MW et al)*
- Prospective, multicenter observational study- Among >19,000 collegiate athletes, 3018 tested + for COVID-19 and underwent cardiac evaluation. Possible cardiac injury noted in 21 (0.7 %), including 15 (0.5 %) who underwent CMR based on findings from preliminary testing (electrocardiogram [ECG], serum troponin, and/or transthoracic echocardiography). During a subsequent one-year period of surveillance, only 1 adverse cardiac event occurred, most likely unrelated to COVID-19 infection *(Petek BJ et al)*

Understanding the Risks: MIS-C

April 2020

NHS
North Central London
Clinical Commissioning Group

Dear colleague

Significant Alert in respect of Children and Paediatric Shock – For Urgent Action

The following information has been sent to us in relation to children presenting with unusual symptoms. **Abdominal pain and gastrointestinal symptoms have been a common feature, as has cardiac inflammation.** We thought it was extremely important to bring this information to your attention in primary care.

Please refer children presenting with these symptoms as a matter of urgency.

It has been reported, that over the last three weeks, there has been an apparent rise in the number of children of all ages presenting with a multisystem inflammatory state requiring intensive care across London and also in other regions of the UK.

The cases have in common overlapping features of toxic shock syndrome and atypical Kawasaki Disease with blood parameters consistent with severe COVID-19 in children.

Abdominal pain and gastrointestinal symptoms have been a common feature, as has cardiac inflammation. This has been observed in children with confirmed PCR positive SARS-CoV-2 infection, as well as children who are PCR negative. Serological evidence of possible preceding SARS-CoV-2 infection has also been observed.

There is a growing concern that a SARS-CoV-2 related inflammatory syndrome is emerging in children in the UK, or that there may be another, as yet unidentified, infectious pathogen associated with these cases.

Please do refer patients as a matter of urgency if you encounter any children presenting with these types of symptoms.

Kind regards

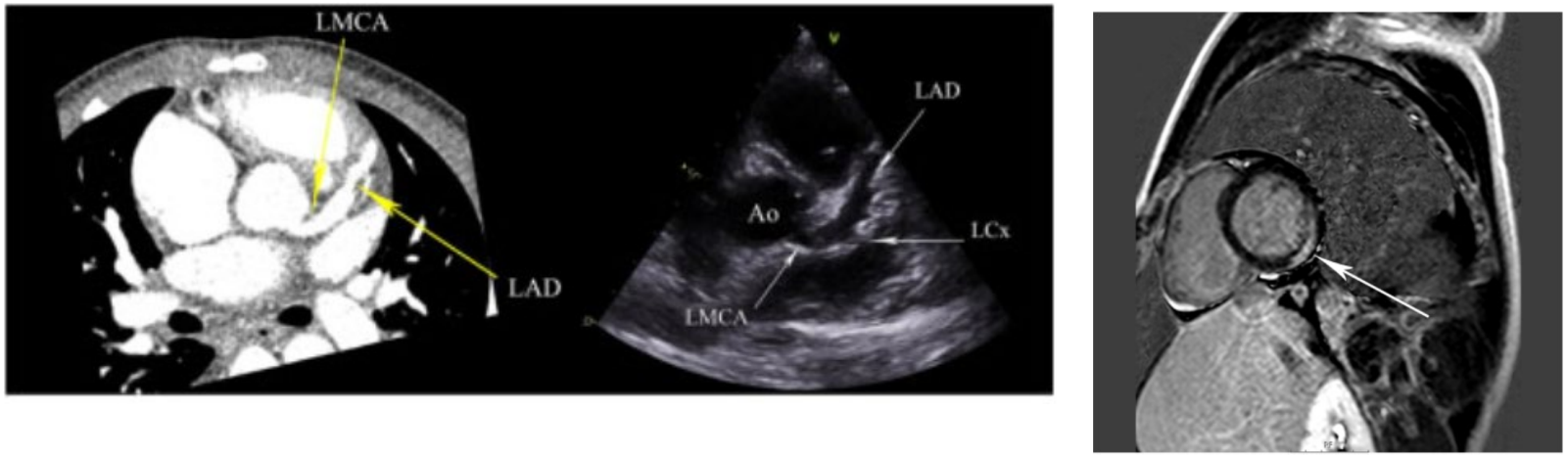
North Central London CCGs' Incident Coordination Centre

Updated CDC case definition

- Clinical criteria: Fever + CRP ≥ 3 mg/dl + hospitalization + > 2 systems involved
- Lab criteria: Recent COVID-19 infection (PCR/ Ag/Ab) in past 60d
- Epidemiologic criteria: Recent COVID-19 exposure in past 60d
- Vital Records criteria: death certificate lists MIS-C as underlying cause/significant contributor of death

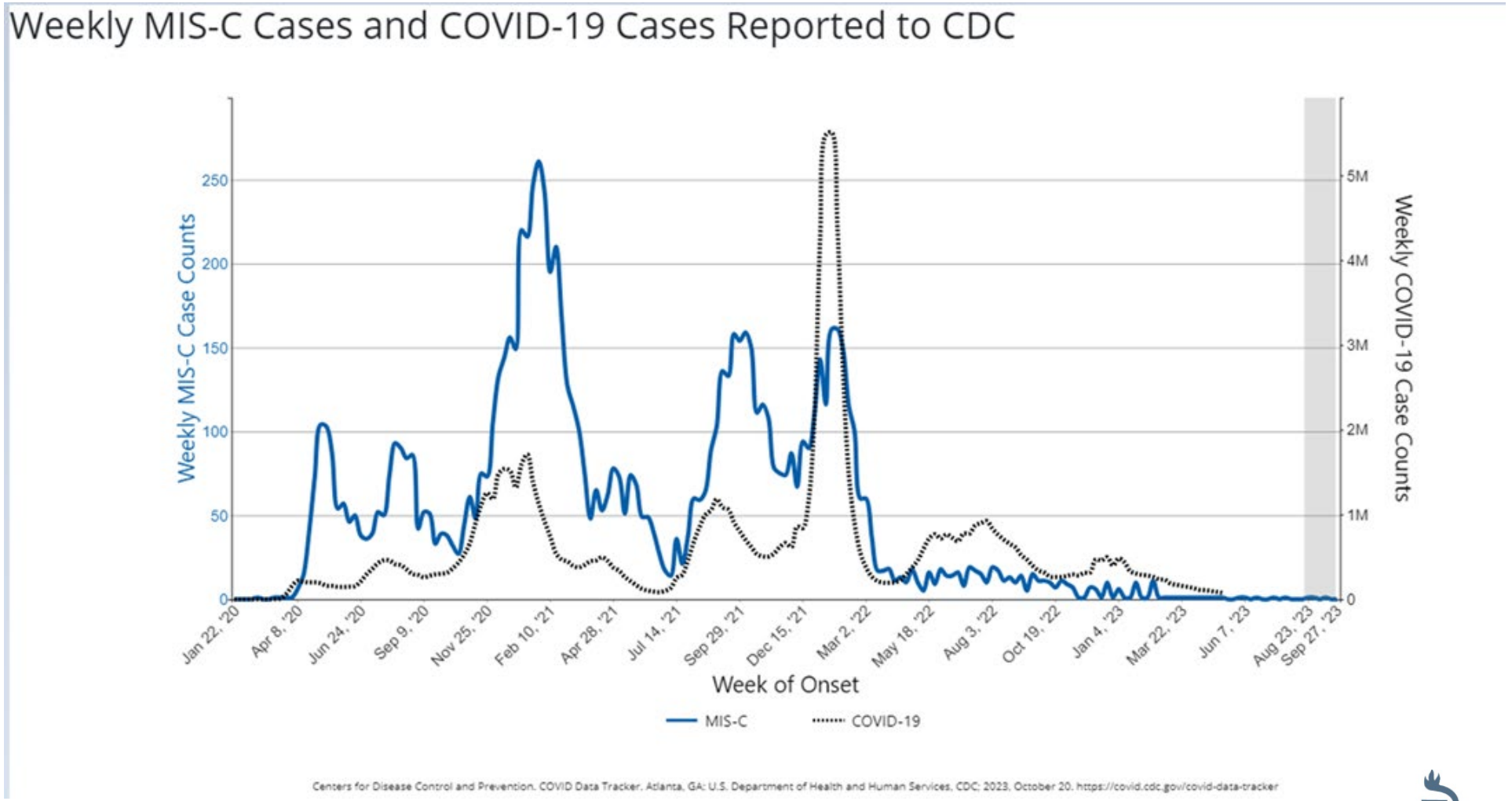
Understanding the Risks: MIS-C

Multimodality cardiac evaluation in children and young adults with multisystem inflammation associated with COVID-19



Theocharis et al; European Heart Journal - Cardiovascular Imaging (2020)

Understanding the Risks: MIS-C



Centers for Disease Control and Prevention. COVID Data Tracker. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2023, October 20. https://covid.cdc.gov/covid-data-tracker

Understanding the Risks: Other

Recovering athletes are susceptible to a number of other COVID-19-related complications

- General fatigue,
- Cognitive dysfunction
- Coagulopathy (eg, deep vein thrombosis, pulmonary embolism)
- Impaired neuromuscular function, and reduced muscle strength
- Residual/ secondary pulmonary damage

Understanding the Risks

- Psychosocial effects of sports, and not participating in sports
- Imposed inactivity can also lead to long term medical conditions: Obesity, hypertension, hyperlipidemia, and metabolic syndrome

Understanding the Risks

Risk of spread:

- Indoor versus Outdoor
- Sports with close contact
- Risks of Travel Sports

Initial Post-COVID restrictions

- Based on expert opinion
- More restrictive
- Somewhat complicated

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Returning To Play After Coronavirus Infection: Pediatric Cardiologists' Perspective

Jul 14, 2020 | Peter N Dean, MD, FACC; Lanier Burns Jackson, MD; Stephen M. Paridon, MD

Expert Analysis

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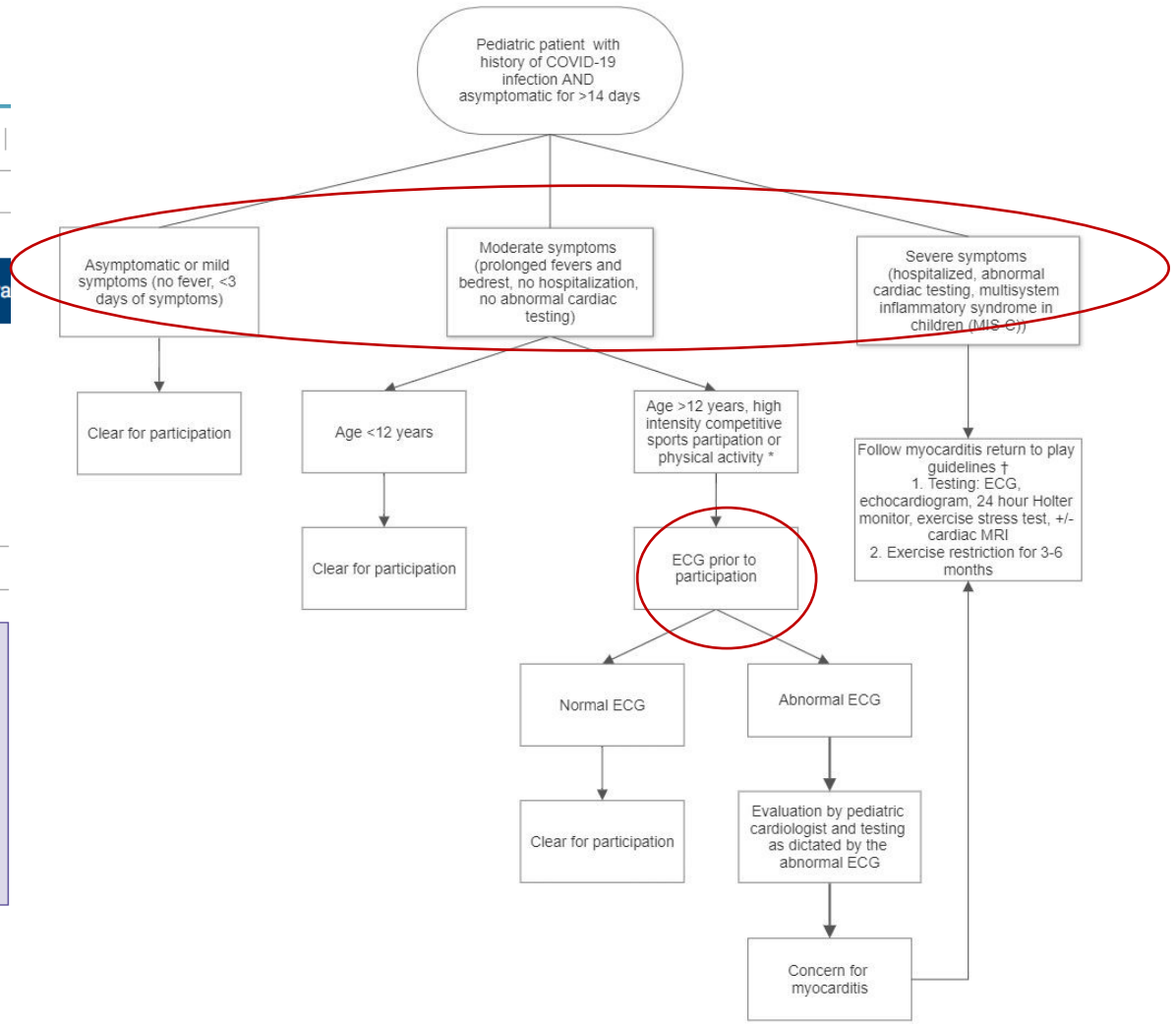
Quick Takes

- Returning to sports participation after a COVID infection will be a significant question posed to pediatric providers in the coming months
- The approach to sports participation clearance in pediatric patients should differ from the approach in adult patients
- Most pediatric patients will be able to be easily cleared for participation without extensive cardiac testing, but pediatric providers should ensure patients have fully recovered and have no evidence of myocardial injury

Return to Play After COVID-19 Infection in Pediatric Patients



Return to play after COVID-19 infection

Adapted from the *AAP COVID-19 Interim Guidance: Sports and Physical Activity in the SARS-CoV-2 Era* by Anna Zuckerman, MD, FAAP and Jonathan Flyer, MD, FAAP, FACC.
For detailed guidance, please refer to the AAP COVID-19 Interim Guidance: Sports and Physical Activity in the SARS-CoV-2 Era. (Last updated 9/9/2022)

Severity of symptoms

Asymptomatic or mild
<4 days of fever >100.4, <1 week of myalgia, chills, or lethargy

Follow-up video visit, phone call or other electronic communication (ie portal message) with PCP prior to resuming physical activity or within 2-4 weeks of a positive SARS-CoV2 test whichever is sooner.

During communication:
1. Guidance re: duration of isolation
2. Do not exercise while in isolation
3. Ask questions about chest pain, shortness of breath out of proportion for upper respiratory tract infection, new-onset palpitations or syncope.

No concerning symptoms reported

Cleared to begin return to play (Box A)

Concerning symptoms reported

In-office visit with complete physical exam (PE) (post-isolation). In patients with symptoms that may involve the cardiac system, such as; chest pain, shortness of breath with exercise (not related to pulmonary issues), syncope, the PCP should have electrocardiogram (EKG) done and interpreted prior to clearance to return. Refer to pediatric cardiologist for abnormal EKG. Exclude from physical activity until cleared by cardiology then return to play (Box A)

Moderate
≥4 days of fever >100.4°F, ≥1 week of myalgia, chills, or lethargy, or a non-ICU hospital stay and no evidence of multisystem inflammatory syndrome in children (MIS-C).

In-person evaluation by PCP after symptom resolution and completion of isolation

During in-person evaluation:
1. Do not exercise until cleared by PCP
2. AHA 14-element screening evaluation, with special emphasis on **chest pain, SOB out of proportion to URI symptoms, new-onset palpitations, or syncope**
3. Complete physical exam
4. EKG

Negative AHA screen, normal exam, and normal EKG

Positive AHA screen, abnormal exam, or abnormal EKG

Refer to cardiology, exclude from physical activity until cleared by cardiology

Cleared to begin the return to play (Box A) after 10 days have passed from symptom onset or positive test

Severe
ICU stay and/or intubation, or **MIS-C**

Restrict from exercise for 3-6 months, obtain cardiology clearance prior to resuming training or competition

Lessons From the Past: Pre COVID-19

Return to Play After Infectious Disease

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Mats Börjesson, Daniel Arvidsson, Christa Janse Van Rensburg, and Martin Schwellnus

Fact Box 3 Influence of acute illness on body systems, which leads to decreased exercise performance

System	Influence
Musculoskeletal	Muscle wasting (decrease in protein content) Decrease in muscle strength (isometric and isotonic) Decrease in muscle endurance Mitochondrial abnormalities
Cardiovascular	Decrease in stroke volume with a reduced cardiac output
Neurological	Impaired motor coordination Decreased neuromuscular transmission
Metabolism	Inability to maintain euglycemia Dehydration

Fact Box 4 Medical complications and risks associated with exercise training in athletes with an acute URT illness

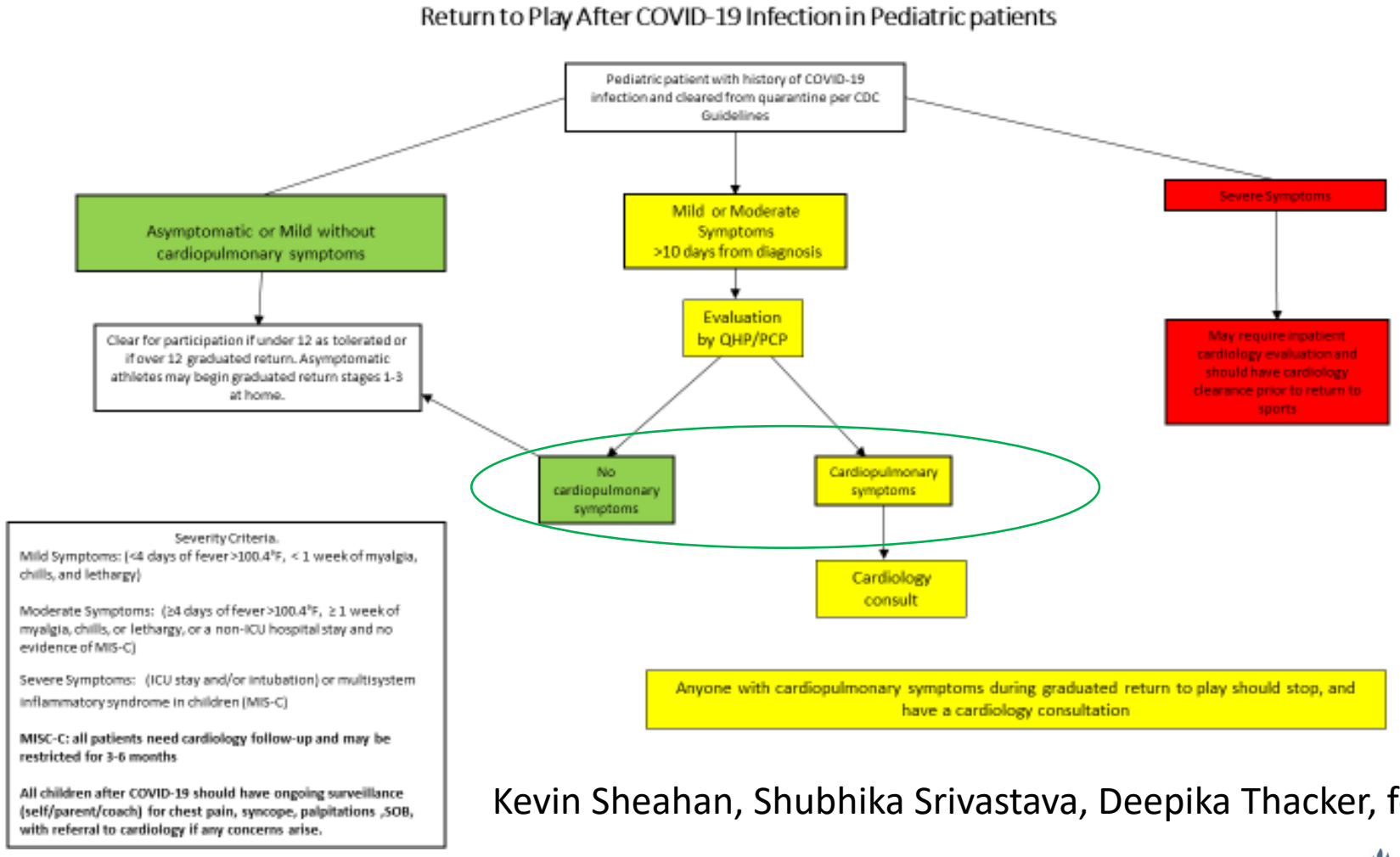
System	Complication
Cardiovascular	Viral myocarditis Myopericarditis Dysrhythmias Sudden death
Musculoskeletal	Rhabdomyolysis Joint, ligament and tendon injuries due to impaired motor coordination
Respiratory system	Bronchial hyperreactivity
Others	Post-viral fatigue syndrome Increased duration and severity of symptoms of illness Heatstroke

- Firstly, and most importantly, return to play should occur only after the infection has cleared. This means that the athlete should have no remaining muscle pain, general malaise, fever or specific symptoms of the disease (diarrhoea, etc.).
- Secondly, RTP is a gradual process. The athlete should be closely monitored and only be allowed to increase training load if he/she is symptom-free. The length of this adjustment period is dependent on the duration and severity of the infection.
- Importantly, the athlete should not be advised to exercise in an alternative fashion, i.e. strength training instead of endurance training, which has sometimes been considered to be a less demanding activity. He or she should abstain from all training during the infection, to give the body a chance to recover fully.

Lessons From Pandemic

- Myocardial injury that occurs following SARS-CoV-2 can result from direct viral injury or more commonly in children, can be immune mediated: can occur regardless of severity of initial infection
- Sudden events are extremely rare
- Presence of exercise related symptoms should be (self) monitored even after clearance to return to sports
- Graduated Return to Sports after ANY illness is likely a good idea!
- Different sports and activities likely provide different levels of risk in return to play should be considered
- Those participating in low intensity activities such as bowling may require less time while those participating in high intensity sports adopt a more gradual return to activity while continuing to monitor for symptoms
- MIS-C patients have excellent outcomes with quick recovery of myocardial function

Return to Play after COVID Infection: 2021 version



Kevin Sheahan, Shubhika Srivastava, Deepika Thacker, for DIAA for 2021-22

Who needs Cardiology Clearance

- 1. Anyone with H/O COVID with cardiac symptoms
- 2. H/O intubation, and has not had a cardiology evaluation
- 3. MIS-C
- If > 6-8 weeks after recovery from COVID and no current concerns, do not need to refer for cardiology clearance

For All Patients

- CDC recommendations for isolation and masking should be followed
- Graduated return to sports
- Longer the illness, more the deconditioning, more gradual escalation of exercise
- At home/gym treadmill based screening stress test is feasible!
- Ensure hydration and rest
- If any cardiac symptoms: refer to cardiology

Graduated Return to Play Protocol

Stage	Period	Max Duration	Activity
1	Day 1-2	15 minutes	Light activity, walking, easy exercise bike (≤70% HR max);
2	Day 3	30 minutes	Above, plus simple movement drills, may consider jogging (≤80% HR max). No resistance training.
3	Day 4	45 minutes	Add more complex training (≤80% HR max) including light resistance training.
4	Day 5-6	60 minutes	Resume normal training activities (≤80% HR max)
6	Day 7	As tolerated	Full participation in usual activities at usual intensity, including competition.

* Adapted from Elliott N, et al, infographic, *British Journal of Sports Medicine,* 2020

*Durations listed are suggested minimums- stages may and likely should be extended in more severe or prolonged cases. Asymptomatic and mild cases may be able to return sooner than recommended here. *Chowdhury D et al. Sports Health. 2022 Jul-Aug;14(4):460-465*

Cardiology Evaluation

- History and Physical
- ECG
- Echocardiogram
- Holter and/ or event monitor
- Stress test
- Blood work (Troponin and BNP)
- In some cases cardiac MRI maybe indicated.

Post Covid Vaccine Myocarditis

Presentation:

- Maximum in Teenage boys

-Typically, on day # 3 after 2nd dose (2 - 10 days), can happen after 1st, but rare

-Presenting symptoms **chest pain**, shortness of breath, palpitations

Early reports of myocarditis after mRNA COVID-19 vaccine: United States

- Marshall et al – 7 healthy males 14-19yo within 4 days of 2nd mRNA vaccine
  - All with abnormal troponin, ECG, and MRI
  - Treatment with NSAIDs alone in 3, IVIG/steroids in 4
  - All discharged to home after 2-6 days in the hospital (median 4)

- Rosner et al* – 5 males 19-39yo within 4 days of 2nd dose of vaccine, 1 24yo male 7 days after 1st dose
  - All with abnormal troponin and MRI findings, varying ECG findings
  - Treatment with NSAIDs or colchicine in 4, beta-blockers in 2, steroids in 1
  - All discharged to home after 2-4 days in the hospital (median 3)
  - Note: Spike protein antibodies **negative** in patient who presented after 1st dose

Marshall et al. *Pediatrics.* 2021.
Rosner et al. *Circulation 2021*
**Rosner et al. also reported a 28yo with myocarditis after Johnson & Johnson's Janssen COVID-19 vaccine*

Early reports of myocarditis after mRNA COVID-19 vaccine: International

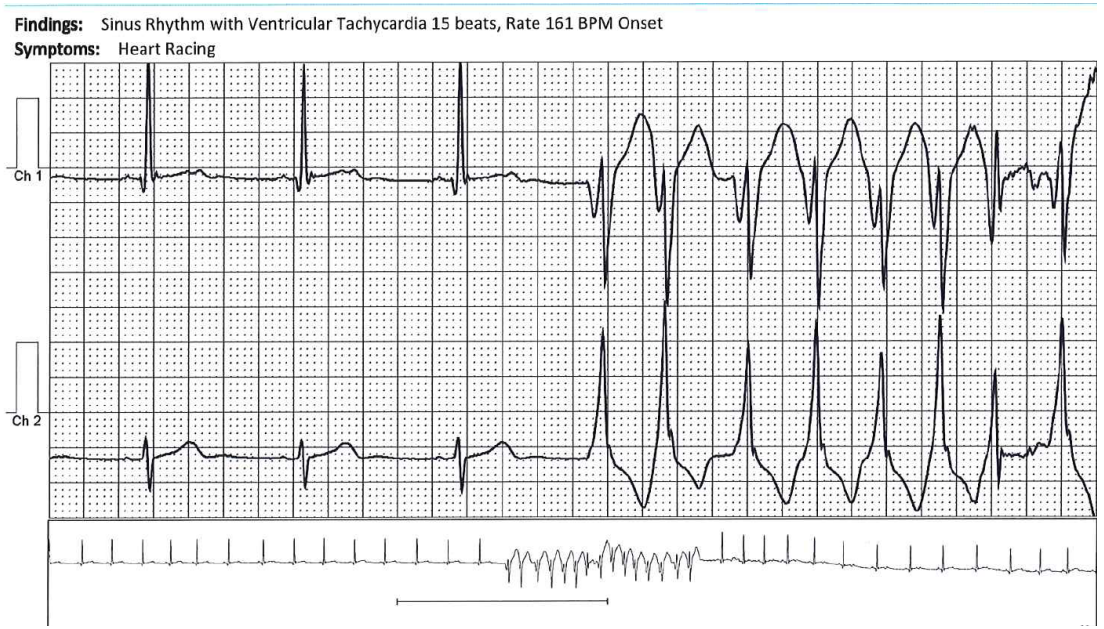
- Larson et al – 8 males 22-56yo (4 in U.S., 4 in Italy); 7 within 4 days of dose 2, 1 with onset 2 days after dose 1 (had hx of prior SARS-CoV-2 infection)
  - All with abnormal troponin, echo, and MRI; 7/8 with abnormal ECG
  - Treatment with NSAIDs or colchicine in 4, steroids in 2, no treatment in 3
  - All discharged home with resolution of symptoms and preserved ejection fraction

- Israeli Ministry of Health - 148 myocarditis cases occurring within 30 days of mRNA vaccine
  - 27 cases out of ~5.4 million first doses
  - 121 cases out of ~5 million second doses
  - Mostly in men aged 16-30 (particularly 16-19)
  - Most were in the hospital up to 4 days
  - 95% of cases considered mild

Larson et al. *Circulation*. 2021
https://www.gov.il/en/departments/news/01062021-03

Our Nemours Experience

- # of patients: 14
- Age 13.9-17y
- Male: ALL 14!
- Cardiac dysfunction: 0
- Vasopressors: 0
- Scheduled NSAIDS: 11 ; PRN: 3
- IVIG: 3
- Steroids: 5
- Needed intubation: 0
- Arrhythmia: 4 non sustained VT, 2 PVCs, 1 sinus pauses
- MRI: only done for 3 : showed myocarditis
- LAST CASE January 2022!



References

- Daniels CJ, Rajpal S, Greenshields JT, Rosenthal GL, Chung EH, Terrin M, Jeudy J, Mattson SE, Law IH, Borchers J, Kovacs R, Kovan J, Rifat SF, Albrecht J, Bento AI, Albers L, Bernhardt D, Day C, Hecht S, Hipskind A, Mjaanes J, Olson D, Rooks YL, Somers EC, Tong MS, Wisinski J, Womack J, Esopenko C, Kratochvil CJ, Rink LD; Big Ten COVID-19 Cardiac Registry Investigators. Prevalence of Clinical and Subclinical Myocarditis in Competitive Athletes With Recent SARS-CoV-2 Infection: Results From the Big Ten COVID-19 Cardiac Registry. JAMA Cardiol. 2021 Sep 1;6(9):1078-1087. doi: 10.1001/jamacardio.2021.2065. PMID: 34042947; PMCID: PMC8160916.
- Kiel RJ, Smith FE, Chason J, Khatib R, Reyes MP. Coxsackievirus B3 myocarditis in C3H/HeJ mice: Description of an inbred model and the effect of exercise on virulence. *Eur J Epidemiol*. 1989;5(3):348-350. doi:10.1007/BF00144836
- Boehmer TK, MMWR Morb Mortal Wkly Rep 2021;70:1228–1232
- Martinez MW, Tucker AM, Bloom OJ, Green G, DiFiori JP, Solomon G, Phelan D, Kim JH, Meeuwisse W, Sills AK, Rowe D, Bogoch II, Smith PT, Baggish AL, Putukian M, Engel DJ. Prevalence of Inflammatory Heart Disease Among Professional Athletes With Prior COVID-19 Infection Who Received Systematic Return-to-Play Cardiac Screening. JAMA Cardiol. 2021 Jul 1;6(7):745-752. doi: 10.1001/jamacardio.2021.0565. PMID: 33662103; PMCID: PMC7934073.
- Petek BJ, Moulson N, Drezner JA, Harmon KG, Kliethermes SA, Churchill TW, Patel MR, Baggish AL; ORCCA Investigators. Cardiovascular Outcomes in Collegiate Athletes After SARS-CoV-2 Infection: 1-Year Follow-Up From the Outcomes Registry for Cardiac Conditions in Athletes. Circulation. 2022 May 31;145(22):1690-1692. doi: 10.1161/CIRCULATIONAHA.121.058272. Epub 2022 May 12. PMID: 35545946.
- https://covid.cdc.gov/covid-data-tracker/#mis-national-surveillance
- https://www.acc.org/latest-in-cardiology/articles/2020/07/01/12/42/returning-to-play-after-coronavirus-infection-a-perspective-from-pediatric-cardiologists
- Elliott N, Martin R, Heron N, Elliott J, Grimstead D, Biswas A. Infographic. Graduated return to play guidance following COVID-19 infection. Br J Sports Med. 2020 Oct;54(19):1174-1175. doi: 10.1136/bjsports-2020-102637. Epub 2020 Jun 22. PMID: 32571796; PMCID: PMC7371566.
- Chowdhury D, Fremed MA, Dean P, Glickstein JS, Robinson J, Rellosa N, Thacker D, Soma D, Briskin SM, Asplund C, Johnson J, Snyder C. Return to Activity After SARS-CoV-2 Infection: Cardiac Clearance for Children and Adolescents. Sports Health. 2022 Jul-Aug;14(4):460-465. doi: 10.1177/19417381211039746. Epub 2021 Aug 24. PMID: 34427496; PMCID: PMC9214892.

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QUESTIONS?

THANK YOU!