Pediatric Sports Clearance After COVID-19

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• SCDY Prevention Committee of the Michigan Congenital Heart Center
• MHSAA Sports Medical Advisory Committee
Outline:

• Are we over- or under-reacting?
• When pandemics collide
• Return-to-Play (RTP) Recs - Pros and Cons
Current RTP Recs - Pros and Cons

GUIDELINES/Expert Consensus:

1. U-M/Mott - DMC Collaboration
2. ACC/Sports Cardiology
3. AAP Interim Guidance

PAPERS/REPORTS (MRI/CMR-based):

1. July – German study (avg 49y) JAMA Cardiology
2. Sept – OSU, college athletes JAMA Cardiology
3. Feb 2021 – Vanderbilt: myocarditis among COVID+ athletes less common than previously reported. Circulation
4. March 2021 Prof. Athletes JAMA Cardiology
March: NBA Patient Zero

NBA TO SUSPEND SEASON FOLLOWING TONIGHT’S GAMES
- NBA Player Tests Positive for COVID-19 -

NEW YORK, March 11, 2020 – The NBA announced that a player on the Utah Jazz has preliminarily tested positive for COVID-19. The test result was reported shortly prior to the tip-off of tonight’s game between the Jazz and Oklahoma City Thunder at Chesapeake Energy Arena. At that time, tonight’s game was canceled. The affected player was not in the arena.

The NBA is suspending game play following the conclusion of tonight’s schedule of games until further notice. The NBA will use this hiatus to determine next steps for moving forward in regard to the coronavirus pandemic.
Then

- **August:** Big 10, Pac-12 postponed seasons.
  The whole world paused - after alarmingly high rates of inflammation were published.
  Studies of middle-aged adults - not young athletes.

Dr. Micheal Ackerman (Mayo Clinic):

- *The heart doesn't deserve to be the center of the universe in this equation.*
- *Don’t stand behind the heart as your reason for canceling the season.*
- *I take care of over 3,000 young pts at risk for SCD from genetic heart disease. We've been reassuring them since March that COVID-19 is not spooky for their hearts and they're not at greater risk of having a bad outcome.*
When Pandemics Collide: The Impact of COVID-19 on Childhood Obesity

COVID-19: a one-way ticket to a global childhood obesity crisis?

American Academy of Pediatrics Raises Concern about Children's Nutrition and Physical Activity During Pandemic
Current Goals

- Reduce SCD risk
- Promote exercise benefits
- Minimize inappropriate restriction
- Reduce mental health burden
COVID-19 – Cardiac Implications

- Immunopathology, Hyperinflammation
- SARS-CoV-2
- Direct Myocardial Injury
- Respiratory failure, Hypoxemia

Biomarkers of Injury
- Arrhythmias
- Acute Coronary Syndromes
- HFrEF, HFpEF

Myocarditis

• A viral worst case scenario
• SCD – also a worst case scenario
Myocarditis

- Inflammation and myocardial injury
- Can lead to scarring, dysfunction, arrhythmias
- Ranges from focal-to-diffuse, asymptomatic-to-fulminant
- With influenza, coxsackievirus, adenovirus.

- Concern that exercising can
  - accelerate viral replication and inflammation, exacerbating myocardial injury
  - precipitate malignant arrhythmias
GUIDELINES - longstanding

No exercise for 3-6 mos, to help with resolution.
MIS-C (Multisystem Inflammatory Syndrome in Children)

- Most pediatric COVID infections are mild or asymptomatic.
- May: CDC defined it, occurring in areas with high COVID rates.
- Hemodynamic instability, myocarditis, respiratory failure - 2-4 weeks after infection.

Myocarditis:
What percent of SCD in athletes?
Causes of SCD in Athletes


6-8%

How to test for myocarditis?
Testing - for inflammation

- **Troponin** - low specificity. Ranges don’t include elite athletes.
- **ECG** - low specificity. Adding ECG to algorithm could be considered expedient and cost-effective, but wouldn’t be effective in athletes with milder illness.
- **Echo** - more helpful.
### ECHO: Normal Athletic Remodeling vs Abnormal

#### “Red Flags” That Increase Suspicion for Pathology

<table>
<thead>
<tr>
<th>Athletic Remodeling</th>
<th>“Red Flags” That Increase Suspicion for Pathology</th>
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</thead>
<tbody>
<tr>
<td>Symmetric dilation of all 4 cardiac chambers</td>
<td>Disproportionate or severe LV dilation (LVEDD &gt;70 mm in men and &gt;60 mm in women)</td>
</tr>
<tr>
<td>No regional structural or functional wall motion abnormalities</td>
<td>Segmental wall motion abnormality</td>
</tr>
<tr>
<td>Symmetric wall thickening &lt;12 mm (&lt;15 mm in black male athletes)</td>
<td>Asymmetric regional wall thickening</td>
</tr>
<tr>
<td>Normal or low-normal EF</td>
<td>LVEF &lt;50%</td>
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</table>
Exercise-Induced Cardiac Remodeling vs. Cardiac Injury from COVID

Echo: symmetrical cardiac chamber dilatation, and low-normal LV function (EF 52%).

Low-normal LV contractility common in endurance athletes. Given clinical uncertainty - cardiac MRI.

MRI = gold-standard - evaluates ventricular inflammation, scarring, myocardial tissue.
LGE - enhancement of mid-lateral LV wall (blue arrows) suggests scarring, fibrosis.

Small regions of scarring vs artifact - MRI imagers need to consider

?SCD risk when there are MRI findings post-COVID

GUIDELINES/Expert Consensus:

1. U-M/Mott - DMC Collaboration
2. ACC/Sports Cardiology
3. AAP Interim Guidance
If you are sick and think or know you have COVID-19

- Stay home until after
  - At least 10 days since symptoms first appeared and
  - At least 24 hours with no fever without fever-reducing medication and
  - Symptoms have improved

If you tested positive for COVID-19 but do not have symptoms

- Stay home until after
  - 10 days have passed since your positive test
Suggested Gradual RTP

• Recommendations for RTP (written detail)
• Recommendations for RTP (algorithm)
• Gradual RTP progression (for PCPs)
• Gradual RTP progression (handout for parents)

From web-page, ‘Health & Safety’ tab
(not endorsement)
Recommendations for Primary Care Providers Regarding Post-COVID-19 Return-to-Play (RTP) for Pediatric Athletes & Patients - ALGORITHM

COVID-19 Infection in pediatric athletes and patients

Asymptomatic*  
- Isolate for 10 days from positive-test date  
- Gradual RTP*  

Mild Symptoms*  
- Fever ≤3 days (oral temp >100.4°F), fatigue, loss of smell/taste, nausea, vomiting, diarrhea, headache, cough, congestion, sore throat  
- Isolate for 10 days from positive-test date  
- Contact PCP  
  - Consider virtual visit*  
  - Gradual RTP*

Moderate Symptoms*  
- Fever >3 days (oral temp >100.4°F), chills, body aches, loss of smell/taste, significant lethargy/fatigue, cough, hypoxia, pneumonia, shortness of breath, chest pain/tightness  
- Isolate for 10 days from positive-test date with at least 10 days asymptomatic++ before gradual RTP*  
- PCP eval*  
  - Virtual / In-person visit

Severe Symptoms  
- Hospitalized or abnormal cardiac testing during acute infection, or MIS-C  
- Pediatric cardiology evaluation  
- Timing of gradual RTP* as determined by cardiology

PCP eval*  
- Virtual / In-person visit

Age ≤ 12 years  
- Gradual RTP*

Age 13 -18 years  
- Consider pediatric cardiology referral prior to gradual RTP*
• 789 test positive (MLB, MLS, NHL, NFL, men’s/women’s NBA).
• 5 (0.6%) - findings suggesting inflammatory heart disease; didn’t compete.
• All had had moderate cases of COVID.
• Long-term heart complications with milder COVID seem unlikely.
• Used May ACC guidelines - safe RTP thus far achieved, with no CV events.
From: *Prevalence of Inflammatory Heart Disease Among Professional Athletes With Prior COVID-19 Infection Who Received Systematic Return-to-Play Cardiac Screening*  

JAMA Cardiol. March 4, 2021  

- 329 (42%) asymptomatic or few sx  
- 460 (58%) significantly symptomatic  
- None severe  

Avg 19 days after +COVID test

30 (3.8%) - abnl cardiac screening -> downstream testing.

5 (0.6%) – suspected inflammatory heart disease -> restriction. All had moderate symptoms.

**COVID RTP Algorithm**

**A**
- Asymptomatic (considered in setting of screening with known exposure or team-/school-/league-based mandatory screening)
  - Rest/no exercise for 2 wk from positive test result
  - Close monitoring for symptom onset or late deterioration
  - Slow resumption of activity after 2 wk from positive test result under guidance of health care team

**M**
- Mild symptoms; not hospitalized
  - During symptomatic period:
    - Rest/recovery with no exercise
    - Reassess for clinical deterioration and consider further cardiac testing and/or hospitalization if development of cardiac symptoms
  - 2 wk of Convalescence without resumption of exercise after symptom resolution
  - Evaluation by a medical professional for consideration of return to activity:
    - hsTn
    - 12-lead electrocardiogram
    - 2-Dimensional echocardiogram
    - Consider additional symptom-guided testing
  - Normal
  - hsTn >99 percentile and/or abnormal cardiac study
    - Follow myocarditis RTP guidelines

**S**
- Significant symptoms; hospitalized
  - During hospitalization:
    - hsTn
    - Consider cardiac imaging per local protocols
  - Normal
  - hsTn >99 percentile and/or abnormal cardiac study
    - Follow myocarditis RTP guidelines

- Rest/recovery with no exercise while symptomatic
- Evaluation by medical professional after minimum of 2 wk of convalescence without resumption of exercise after symptom resolution
- Consider convalescent cardiac testing if not performed while hospitalized
- Slow resumption of activity under guidance of health care team
- Close monitoring for clinical deterioration
ACC Guidelines

• COVID symptom-burden should guide evaluation.
• No CV risk stratification needed in those who were
  • asymptomatic or had mild COVID symptoms and
  • asymptomatic after isolation.

Prevalence of Inflammatory Heart Disease Among Professional Athletes With Prior COVID-19 Infection Who Received Systematic RTP Cardiac Screening. Martinez et al. JAMA Cardiol. March 4, 2021
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   Circulation
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   JAMA Cardiology
#1 Outcomes of Cardiac MRI in Patients Recently Recovered From COVID

- 100 German pts (mean age 49): MRI involvement in 78%, independent of preexisting conditions, illness severity, time from dx.

July: Puntmann et al. JAMA Cardiol. 2020;5:1265.


Following Twitter takedown, errors addressed but lingering cardiac damage still cited.
Sept JAMA Cardiology:

- 26 college athletes: 4 (15%) had MRI findings suggesting myocarditis
- 8 other athletes (31%): LGE suggesting prior myocardial injury.
- No COVID-negative athletic control group.
- No ECG changes, otherwise-normal echo/MRI, none w/elevated troponin.

No comparison group – ?healing myocarditis vs. athletic remodeling

Importance of athletic controls when interpreting MRI in COVID+ athletes
Vanderbilt: COVID Cardiac Pathology in Athletes With Cardiac MR (‘COMPETE CMR’) 

- 59 Athletes - avg. 21 days after illness; all asymptomatic or mild 
- vs. 60 Athletic controls: had MRI before COVID-19 appeared 
- vs. 27 controls. 
  - 2 - asymptomatic COVID+ athletes (3%) met MRI criteria for myocarditis
    - they had normal ECGs, troponin, and echos. 
    - Focal LGE – no difference! 22% of COVID+ vs. 24% of athletic controls. 

Myocarditis is less common than previously reported. 

#3 Vanderbilt: COVID Cardiac Pathology in Athletes With Cardiac MR (‘COMPETE CMR’)

- Athletes commonly have focal areas of benign scar from athletic remodeling - evident in both athletic groups.
- More ‘scarring’ in healthy heart muscle than we knew.

1. What to do for those who test positive?
2. Afterwards, how to return to play?
1. What to do for those who test positive? (AAP)

- Those who tested positive within 6 months should visit their pediatricians for a post-illness visit before returning to physical activity.

- **Asymptomatic and mild cases** (<4 days fever >100.4°F, < 1 wk of myalgia, chills, and lethargy):
  - Individuals who test positive should not exercise until cleared by a physician.
  - After isolation time, it is suggested they visit with their PCP who will review the AHA 14-element screening evaluation with emphasis on cardiac symptoms including ... and perform a complete physical examination. If those are normal, no further testing is warranted.
  - May begin a gradual RTP (after 10 days from positive test and a minimum of 24 hrs symptom-free off-fever reducing medications). If PCP identifies a concerning cardiac history or exam findings, an ECG should be considered, and referral should be made to a pediatric cardiologist for evaluation and further testing.

- **Moderate symptoms** (≥4 days fever >100.4°F, ≥ 1 wk of myalgia, chills, or lethargy, or a non-ICU hospital stay, no evidence of MIS-C):
  - An evaluation by their PCP is recommended. Individuals who test positive should not exercise until cleared by a physician.
  - PCP evaluation is currently recommended after symptom resolution ... and at a minimum of 10 days ... The PCP will review the AHA ... and perform a complete physical examination and an ECG. If cardiac workup is negative, gradual RTP may be initiated after 10 days have passed ...
  - If cardiac screening is positive, or EKG is abnormal, referral to a cardiologist is recommended. The cardiologist may consider ordering a troponin test and an echocardiogram at the time of acute infection. Depending on symptoms and duration, additional testing including a Holter, exercise stress testing, or MRI may be considered.
  - If cardiac workup is negative, gradual return to physical activity may be allowed after 10 days have passed from ...

- **Severe symptoms** (ICU stay and/or intubation) or MIS-C:
  - It is recommended they be restricted from exercise for minimum 3-6 mos and obtain cardiology clearance prior to resuming training or competition.
  - Follow-up cardiology care should be arranged prior to discharge.
2. After testing positive, how to return to physical activity and/or sports? (AAP)

1. Once isolation completed and cleared to RTP by a physician, another visit with the physician for a final clearance is not required (unless concerning symptoms develop when activity resumes).

2. The AAP recommends not returning to sports/physical activity until one can perform activities of daily living and has no concerning symptoms.

   Those younger than 12 may resume sports/gym according to their tolerance.

   For those 12 and older, a graduated RTP protocol can begin once:
   - cleared by a physician,
   - the minimum amount of time without COVID symptoms has passed, and
   - one does not exhibit cardiorespiratory symptoms during activities of daily living.

3. RTP progression should be over a 7-day period at a minimum. Consider extending the progression for those who had moderate COVID symptoms.
Gradual RTP + Watch for Red Flags

- chest pain
- unusual shortness of breath
- palpitations
- dizziness or fainting, especially with exercise
- marked reduction in fitness

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<table>
<thead>
<tr>
<th>Duration</th>
<th>Type of activity</th>
<th>Examples of exercise allowed</th>
<th>Time</th>
<th>% Heart Rate Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 1-2 days</td>
<td>Light</td>
<td>Walking, Elliptical, Stationary Bike at low intensity</td>
<td>15 minutes</td>
<td>&lt;70%</td>
</tr>
<tr>
<td>At least 1 day</td>
<td>Increase frequency</td>
<td>Jogging, Running Drills, Stationary Bike at increased intensity, Jump Rope</td>
<td>30 minutes</td>
<td>&lt;80%</td>
</tr>
<tr>
<td>At least 1 day</td>
<td>Increase duration and complexity</td>
<td>Sport-specific drills, more complex drills</td>
<td>45 minutes</td>
<td>&lt;80%</td>
</tr>
<tr>
<td>Over 1-2 days</td>
<td>Increase intensity</td>
<td>Normal practice activities</td>
<td>60 minutes</td>
<td>&lt;80%</td>
</tr>
<tr>
<td>At least 1 day</td>
<td>Participate in usual sport-specific activities</td>
<td>Complete practice</td>
<td>Entire practice</td>
<td></td>
</tr>
</tbody>
</table>

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

RETROSPECTIVE VS PROSPECTIVE STUDY
Registries:

Outcomes Registry for Cardiac Conditions in Athletes, ORCCA:
To answer debate in college sports about safety of RTP and guidelines.
Starting point for long-term investigation in those diagnosed with COVID and other heart conditions.
Registries: MIS-C

The Long-Term Outcomes after the Multisystem Inflammatory Syndrome in Children (MUSIC) study

Examine long-term effects on
- ventricular function
- nervous, lung, immune, GI systems.
No screening approach is perfect

• There is a measurable non-zero risk of a catastrophic head injury this season or spine injury; lots of things can happen.
• There is a non-zero risk when fans drive down the interstate that they're going to get hit by a person who was texting while driving.
Heart-Safe Communities

- Bystander responsiveness
- Hands-Only CPR

Deadline May 15th
See MDHHS website

https://migrc.org/patients-families/mi-heartsafe-schools/
Summary:

• Asymptomatic, mild cases all need clearance.
• Moderate cases – probably. Video visits may be OK.
• MIS-C and severe cases - restriction for 3-6 months.
• Gradual RTP after isolation, watching for red flags.
• Athletes: Exercise-induced remodeling may be misinterpreted as COVID-injury (by MRI).
• The world paused after seeing alarmingly high rates of myocardial inflammation. But there’s more ‘scarring’ in healthy heart muscle than we would have thought.
• Proven: Best to be prepared for SCA, with quick bystander response.