

# COVID-19 and Myocarditis

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## DISCLOSURE

No Relevant Financial Relationship(s)

Dr. Leslie Cooper

Off Label/Investigational Usage

None



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## Myocarditis revealing COVID-19 infection in a young patient

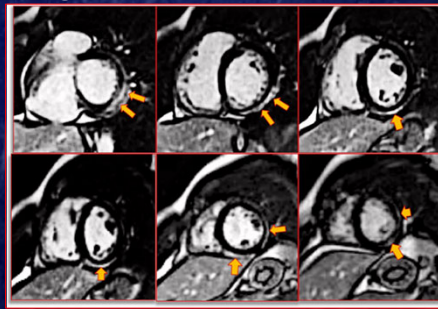
Jean-François Paul ✉, Pierre Charles, Clémence Richaud, Christophe Caussin, Christelle Diakov

European Heart Journal - Cardiovascular Imaging, jeaa107, <https://doi.org/10.1093/ehjci/jeaa107>

Published: 27 April 2020

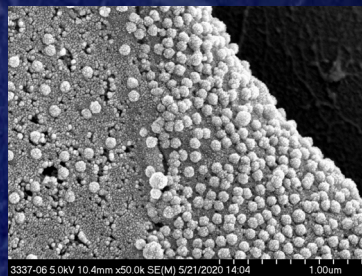
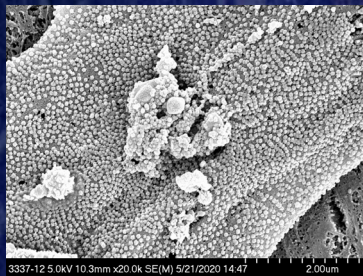
33 yo man treated at the Institut Mutualiste Montsouris, Paris

Chest pain, normal left ventricular function.  
Troponin I peak 2885 ng/L



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## SARS-COV-2 IN IPS CARDIOMYOCYTES



Courtesy of Jay Schneider, Mayo Clinic Rochester

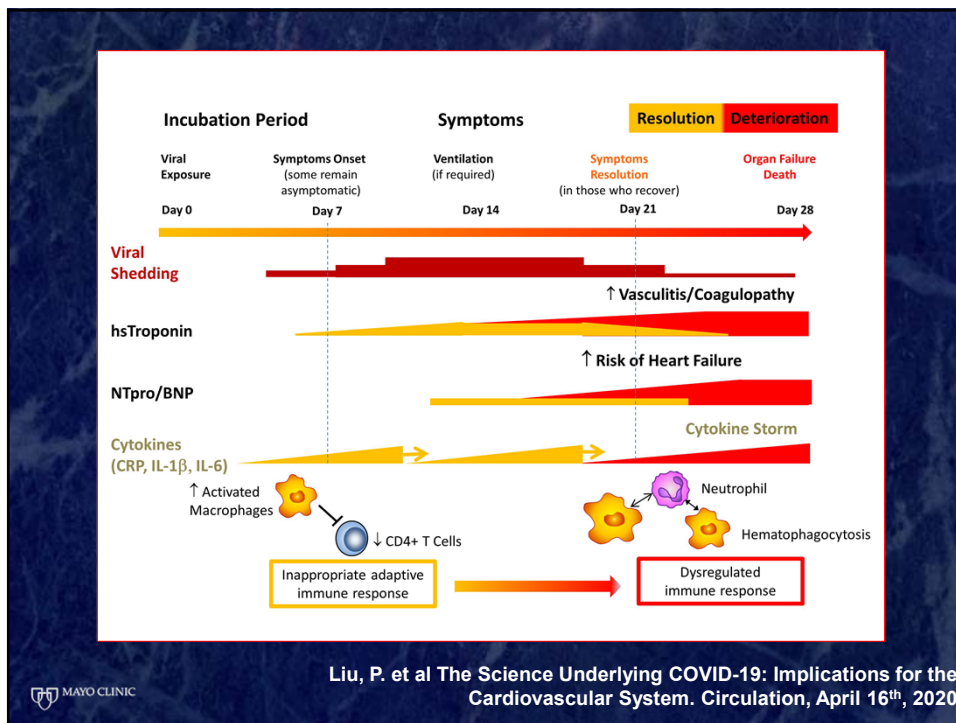
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## Outcomes of Cardiovascular Magnetic Resonance Imaging in Patients Recently Recovered From Coronavirus Disease 2019 (COVID-19)

Valentina O. Puntmann, MD, PhD; M. Ludovica Carerj, MD; Imke Wieters, MD; Masia Fahim; Christophe Arendt, MD; Jędrzej Hoffmann, MD; Anastasia Shchendrygina, MD, PhD; Felicitas Escher, MD; Mariuca Vasa-Nicotera, MD; Andreas M. Zeiher, MD; Maria Vehreschild, MD; Eike Nagel, MD

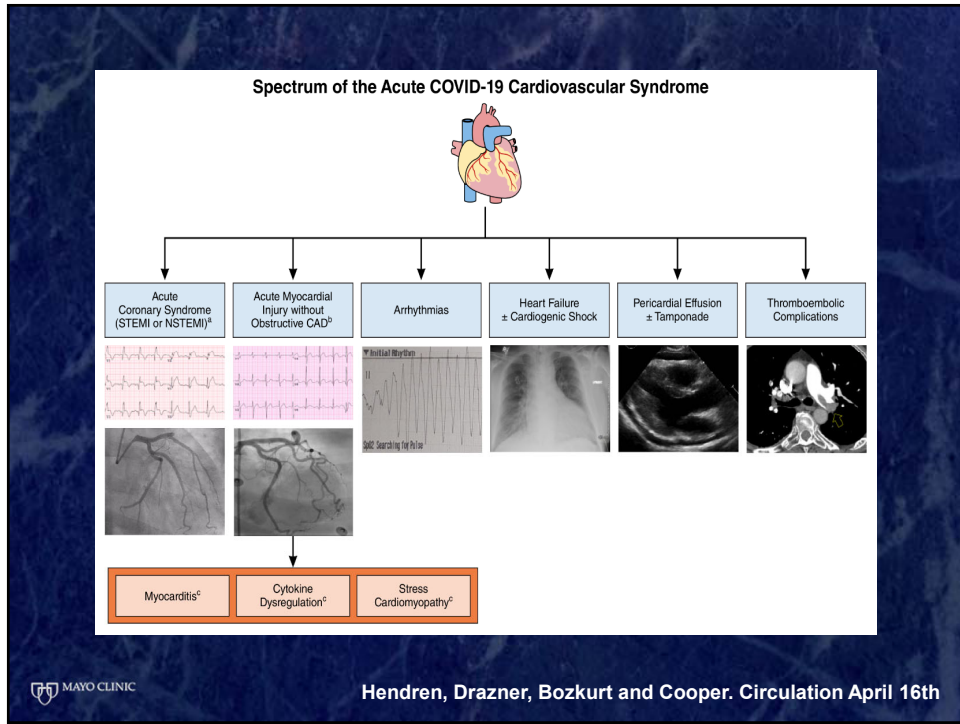
- 100 COVID-19 recovered patients; 53% male; 49 yrs; 71 days from illness to MRI
- 78% had abnormal MRI findings (71 T1; 60 T2; 32 DGE. HS TnT correlated with T1.
- Select EMB revealed lymphocytic myocarditis

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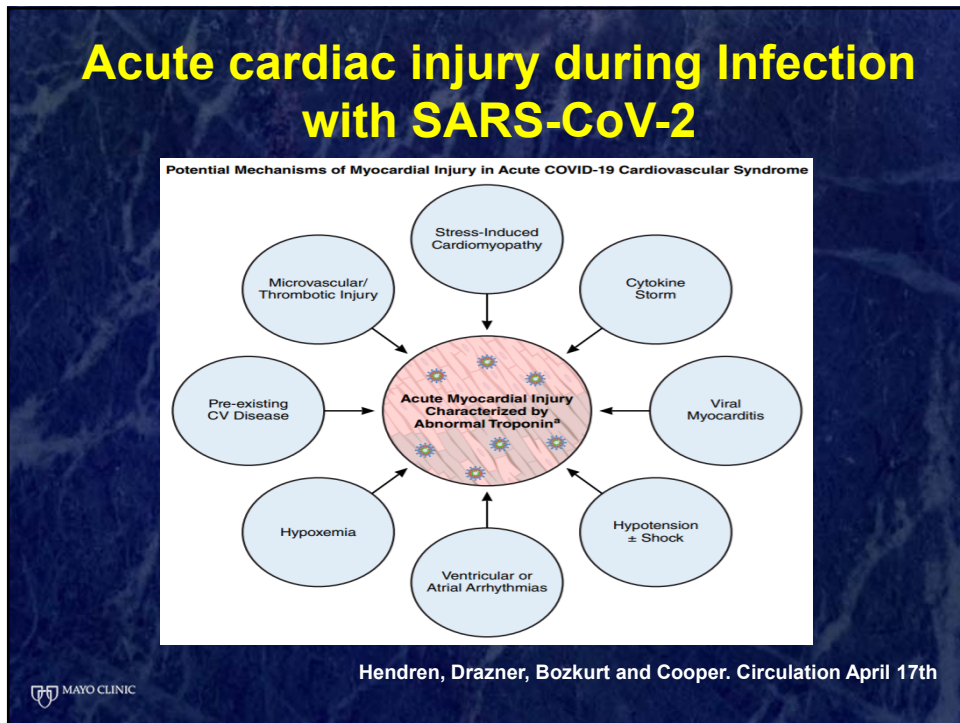


Liu, P. et al The Science Underlying COVID-19: Implications for the Cardiovascular System. Circulation, April 16<sup>th</sup>, 2020

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**SARS-coronavirus modulation of myocardial ACE2  
expression and inflammation in patients with SARS**

G. Y. Oudit, Z. Kassiri, C. Jiang, P. P. Liu, S. M. Poutanen, J. M. Penninger, J. Butany

- **SARS-CoV viral RNA was detected in 35% (7/20) of autopsied heart samples**
- **Macrophage-specific staining showed a marked increase in macrophage infiltration with evidence of myocardial damage in patients who had SARS-CoV in their hearts.**

## **Postmortem Examination of 10 Patients With COVID-19**

Mild lymphocytic myocarditis and signs of epicarditis were detectable in 4 and 2 cases, respectively.

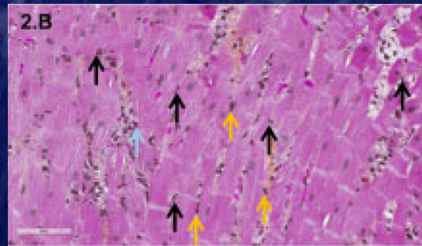
Liver histology showed minimal periportal lymphoplasmacellular infiltration and signs of fibrosis.

There was no morphologically detectable pathology in other organs. Specifically, no signs of encephalitis or central nervous system vasculitis were found.

## Endomyocardial biopsy findings in Kawasaki-like disease associated with SARS-CoV-2

Marc Bonnet <sup>1\*</sup>, Anne Champagnac <sup>2</sup>, Pierre Lantelme <sup>1</sup>, and Brahim Harbaoui <sup>1</sup>

COVID-19 can present as a delayed multisystem inflammatory syndrome (Kawasaki-like disease)  
Associated with acute heart failure



14% of children get coronary aneurysms



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Research Letter

ONLINE FIRST FREE

September 11, 2020

## Cardiovascular Magnetic Resonance Findings in Competitive Athletes Recovering From COVID-19 Infection

Saurabh Rajpal, MBBS, MD<sup>1</sup>; Matthew S. Tong, DO<sup>1</sup>; James Borchers, MD, MPH<sup>1</sup>; et al

- 26 competitive college athletes; 15 male
- 27% mildly symptomatic
- Four athletes (15%; all male individuals) had CMR findings consistent with myocarditis



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## Summary

- Broad clinical spectrum of SARS-CoV-2 associated cardiac injury
- Multiple mechanisms include cytokines, stress, thrombosis and myocarditis
- The influence of abnormal cardiac MRI features on subsequent risk of arrhythmias during sports participation remains unknown



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## Cardiac Involvement in recovered COVID-19 patients identified by Magnetic Resonance Imaging

26 recovered COVID-19 patients that reported cardiac symptoms.

Fifteen (58%) had abnormal MRI findings on conventional MRI sequences: myocardial edema was found in 14 (54%) and LGE was found in 8 (31%).

Decreased RV functional parameters including EF, CI, and SV/BSA were found in patients with positive conventional MRI findings.

Global native T1, T2, and ECV were significantly elevated in patients with positive conventional MRI findings, compared to patients without positive findings and controls.

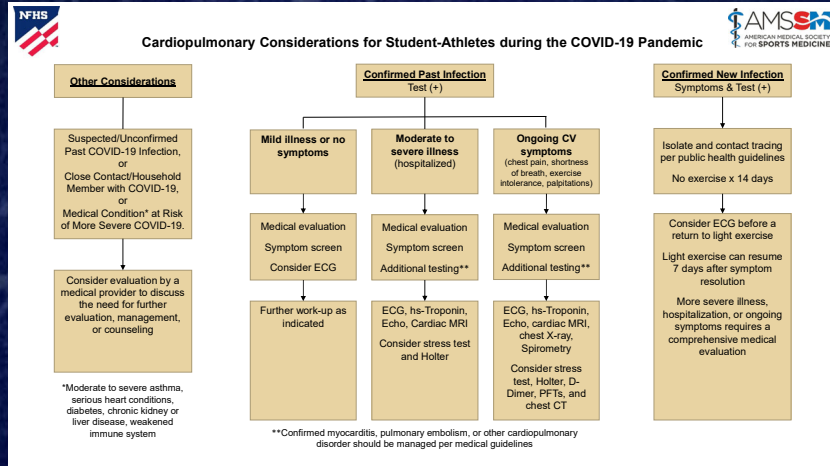
Myocardial edema, fibrosis, and impaired RV function was found in a proportion of the recovered COVID-19 patients.

Huang, Lu et al. <http://imaging.onlinejacc.org/content/jimg/early/2020/05/05/j.jcmg.2020.05.004/F1.medium.gif>



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# National Federation of State High School Associations (NFHS) and the American Medical Society for Sports Medicine (AMSSM)



Sports Health 2020; DOI: 10.1177/1941738120941490

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ESC European Society of Cardiology | European Journal of Heart Failure (2020) | doi:10.1002/ehf.1828 | CASE REPORT

## Myocardial localization of coronavirus in COVID-19 cardiogenic shock

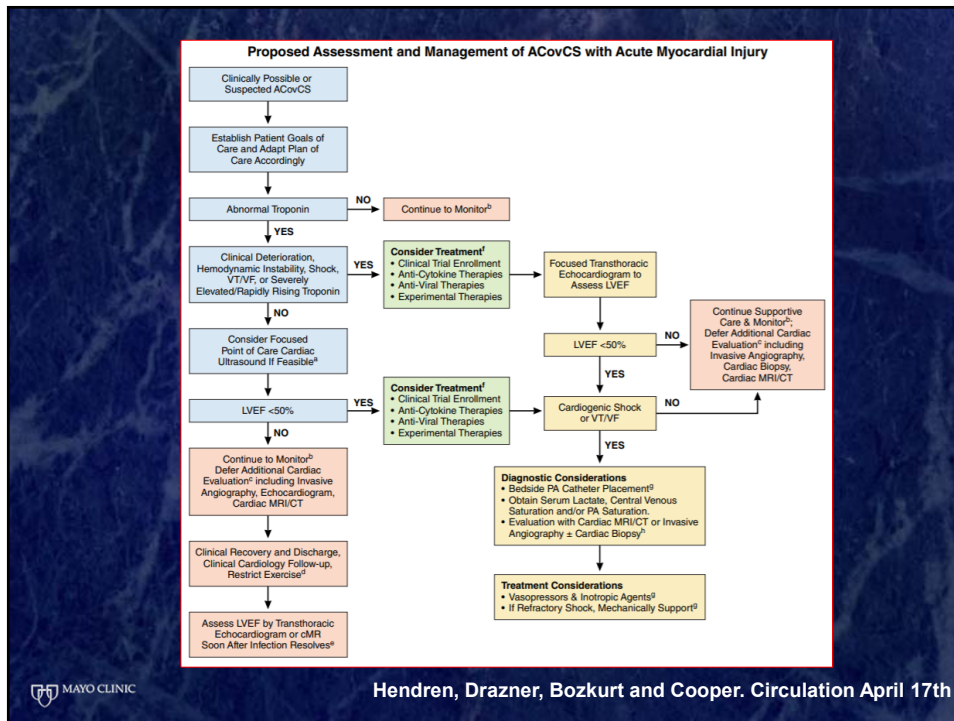
Guido Tavazzi<sup>1,2</sup>, Carlo Pellegrini<sup>1,3</sup>, Marco Maurelli<sup>4</sup>, Mirko Belliato<sup>2</sup>, Fabio Sciutti<sup>2</sup>, Andrea Bottazzi<sup>2</sup>, Paola Alessandra Sepe<sup>5</sup>, Tullia Resasco<sup>5</sup>, Rita Camporotondo<sup>6</sup>, Raffaele Bruno<sup>1,7</sup>, Fausto Baldanti<sup>1,8</sup>, Stefania Paulucci<sup>8</sup>, Stefano Pelenghi<sup>3</sup>, Giorgio Antonio Iotti<sup>1,2</sup>, Francesco Mojoli<sup>1,2\*</sup>, and Eloisa Arbustini<sup>9\*</sup>

- 69 yo with cardiogenic shock and fulminant myocarditis treated with VA-ECMO

Eur Ht J April 7<sup>th</sup>

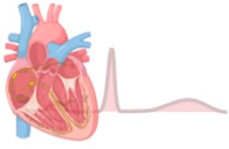
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## Mechanisms and Management Strategies of Arrhythmias in COVID-19

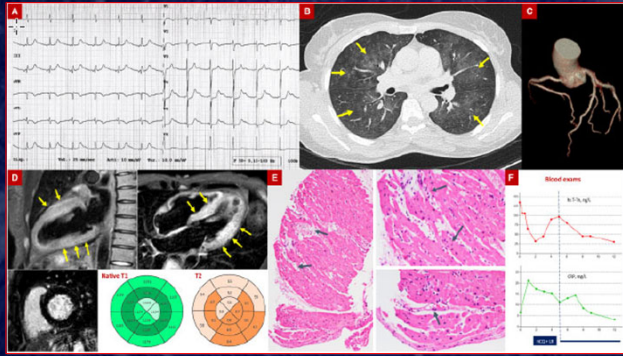
Arrhythmic manifestations with COVID-19	Potential mechanisms of arrhythmias
	<ul style="list-style-type: none"> <li>• Hypoxia</li> <li>• Myocarditis</li> <li>• Abnormal host immune response</li> <li>• Myocardial Ischemia</li> <li>• Myocardial strain</li> <li>• Electrolyte derangements</li> <li>• Intravascular volume imbalances</li> <li>• Drug side effects</li> </ul>
<b>Management strategies</b>	
<ul style="list-style-type: none"> <li>• Supraventricular tachycardia</li> <li>• Atrial Fibrillation</li> <li>• Atrial Flutter</li> <li>• Complete Heart Block</li> <li>• Cardiac Arrest</li> <li>• Polymorphic Ventricular Tachycardia</li> <li>• Monomorphic Ventricular Tachycardia</li> <li>• Multifocal ventricular tachycardia</li> </ul>	<ul style="list-style-type: none"> <li>• Generalized management : treatment like in all non-COVID critically ill patients</li> <li>• Specialized management:               <ul style="list-style-type: none"> <li>- Consideration in inherited arrhythmia syndrome</li> <li>- Management of QTc prolongation in patients receiving COVID-19 therapy</li> <li>- Cardiac drug interaction with COVID-19 therapy</li> </ul> </li> <li>• Optimized management:               <ul style="list-style-type: none"> <li>- Minimizing exposure to the patients and the EP team</li> <li>- Triaging EP procedures</li> </ul> </li> </ul>

Dherange, et al. JACC: Clinic EP (8-14-2020), doi: <https://doi.org/10.1016/j.jacep.2020.08.002>

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Acute myocarditis presenting as a reverse Tako-Tsubo syndrome in a patient with SARS-CoV-2 respiratory infection



Eu Heart J 4-10-2020; doi:10.1093/eurheartj/ehaa286

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