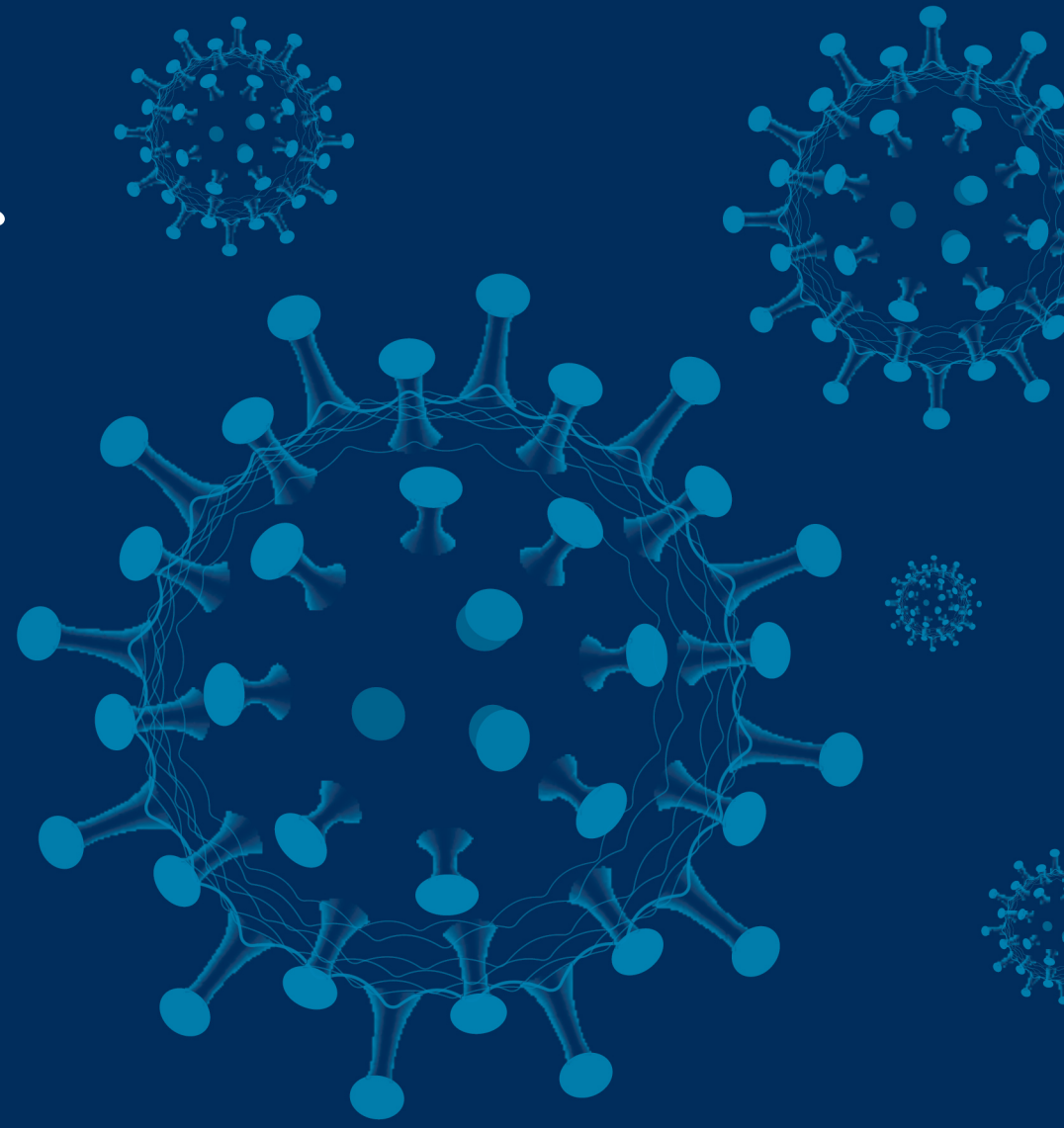
AMERICAN COLLEGE of CARDIOLOGY

COVID-19

Cardiovascular Impact of COVID-19 Care Strategies for Children and Adults



August 4, 2020

Speakers

- Amit Khera, MD, FACC, Moderator
- Tamara Bradford, MD, FACC
- Anuradha (Anu) Lala, MD, FACC
- Kurram Nasir, MBBS, FACC

Presenter Disclosure Information

- Amit Khera, MD, FACC, Moderator
  - Nothing to disclose
- Tamara Bradford, MD, FACC
  - Nothing to disclose
- Anuradha (Anu) Lala, MD, FACC
  - Zoll : Fellows' symposia
- Kurram Nasir, MBBS, FACC
  - Nothing to disclose

AMERICAN COLLEGE of CARDIOLOGY

COVID-19

COVID-19 in Children: Essentials of the Cardiovascular Team

Tamara T. Bradford, MD, FACC, FAAP

Children's Hospital New Orleans and

Louisiana State University Health Science Center

Impact of COVID-19 in Pediatrics

- Infection in children has been less severe than in adults
  - >90% of children have mild or moderate disease
  - Rare cases of multi-organ involvement have been reported
  - Mortality rate <1%
- Clinical manifestations most commonly include fever, respiratory and GI symptoms
- No data indicating increased risk of severe disease in children with underlying illnesses
- **Thus far, the most significant cardiac manifestation in the pediatric population has been multisystem inflammatory syndrome in children (MIS-C)**

AMERICAN COLLEGE of CARDIOLOGY

COVID-19 Hub

An outbreak of severe Kawasaki-like disease at the Italian epicentre of the SARS-CoV-2 epidemic: an observational cohort study

Lucio Verdoni, Angelo Mazza, Annalisa Gervasoni, Laura Martelli, Maurizio Ruggeri, Matteo Ciuffreda, Ezio Bonanomi, Lorenzo D'Antiga

Summary

Background The Bergamo province, which is extensively affected by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic, is a natural observatory of virus manifestations in the general population. In the past month we recorded an outbreak of Kawasaki disease; we aimed to evaluate incidence and features of patients with Kawasaki-like disease diagnosed during the SARS-CoV-2 epidemic.

Methods All patients diagnosed with a Kawasaki-like disease at our centre in the past 5 years were divided according to symptomatic presentation before (group 1) or after (group 2) the beginning of the SARS-CoV-2 epidemic. Kawasaki-like presentations were managed as Kawasaki disease according to the American Heart Association indications. Kawasaki disease shock syndrome (KDSS) was defined by presence of circulatory dysfunction, and macrophage activation syndrome (MAS) by the Paediatric Rheumatology International Trials Organisation criteria. Current or previous infection was sought by reverse-transcriptase quantitative PCR in nasopharyngeal and oropharyngeal swabs, and by serological q

Findings Group 1 co 1, 2015, and Feb 17, 2020. G between Feb 18 and April 2(disease

Published Online
May 13, 2020
https://doi.org/10.1016/S0140-6736(20)31103-X

See Online/Comment
https://doi.org/10.1016/S0140-6736(20)31129-6

Paediatric Department (L Verdoni MD, A Mazza MD, A Gervasoni MD, L Martelli MD, M Ruggeri MD, L D'Antiga MD), **Paediatric Cardiology** (M Ciuffreda MD), **and Paediatric Intensive Care Unit** (E Bonanomi MD), **Hospital Papa Giovanni XXIII, Bergamo, Italy**

Correspondence to:
Dr Lorenzo D'Antiga, Paediatric

Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with Coronavirus Disease 2019 (COVID-19)

HAN HEALTH ALERT NETWORK

This is an official CDC HEALTH ADVISORY

Distributed via the CDC Health Alert Network
May 14, 2020, 4:45 PM ET
CDCHAN-00432

Summary
The Centers for Disease Control and Prevention (CDC) is providing 1) background information on several cases of a recently reported multisystem inflammatory syndrome in children (MIS-C) associated with coronavirus disease 2019 (COVID-19); and 2) a case definition for this syndrome. CDC recommends healthcare providers report any patient who meets the case definition to local, state, and territorial health departments to enhance knowledge of risk factors, pathogenesis, clinical course, and treatment of this syndrome.

RCPCH
Royal College of Paediatrics and Child Health
Leading the way in Children's Health

Guidance: Paediatric multisystem inflammatory syndrome temporally associated with COVID-19

Most children are asymptomatic or exhibit mild symptoms from COVID-19 infection. However, in the last two months a small number of children have been identified who develop a significant systemic inflammatory response. All children have been diagnosed and managed appropriately along standard referral pathways. Affected children may require paediatric intensive care and input from paediatric infectious diseases, cardiology, and rheumatology.

This rare syndrome shares common features with other paediatric inflammatory conditions including: Kawasaki disease, staphylococcal and streptococcal toxic shock syndromes, bacterial sepsis and macrophage activation syndromes. It can also present with unusual abdominal symptoms with excessive inflammatory markers.

Early recognition by paediatricians and specialist referral including to critical care is essential. Advice currently given to families and carers of children and young people (for example RCPCH parent advice during COVID-19 leaflet) supports appropriate referral to health services.

NYC Health

2020 Health Alert #13: Pediatric Multi-System Inflammatory Syndrome Potentially Associated with COVID-19

- **Fifteen cases compatible with multi-system inflammatory syndrome have been identified in children in New York City hospitals.**
- **Characterized by persistent fever and features of Kawasaki disease and/or toxic shock syndrome; abdominal symptoms common**
- **Cases may require intensive care unit admission for cardiac and/or respiratory support**
- **Polymerase chain reaction testing for SARS-CoV-2 may be positive or negative**
- **Early recognition and specialist referral are essential, including to critical care if warranted**
- **Immediately report cases to the New York City Health Department's Provider Access Line: 866-692-3641**

May 4, 2020

Dear Colleagues,

A pediatric multi-system inflammatory syndrome, recently reported by authorities in the United Kingdom,[1] is also being observed among children and young adults in New York City and elsewhere in the United States. Clinical features vary, depending on the affected organ system, but have been noted to include features of Kawasaki disease or features of shock; however, the

PATIENT PRESENTATION WITH CLINICAL SUSPICION OF CMIS

Patients may have a preceding illness consistent with COVID-19 or had a COVID-19 sick contact

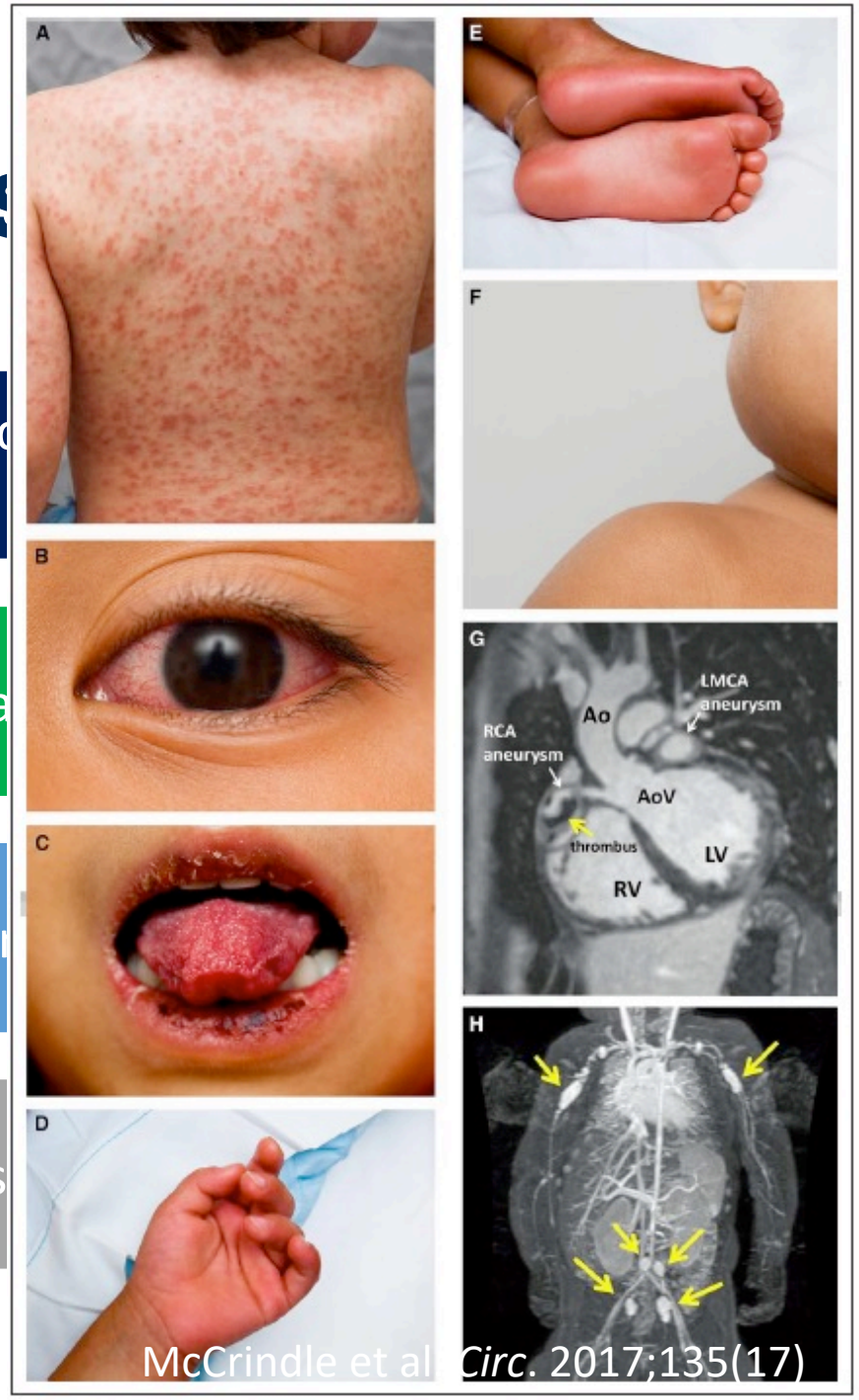
- **Systemic Inflammation**
  - Fever
  - Myalgias
  - Tachycardia
  - Hypotension
  - Hypoperfusion or hyperperfusion
  - Lymphadenopathy/lymphadenitis
- **Cardiopulmonary**
  - Respiratory distress
  - Chest pain
- **Neurologic**
  - Headache
  - Altered mental status
  - Meningismus
  - Focal deficits
  - Seizure
- **Mucocutaneous**
  - Rash - reticular, morbilliform, purpuric
  - Lip swelling/cracking
  - Strawberry tongue
  - Extremity swelling/peeling
  - Conjunctivitis
  - Blisters or erosions
- **Gastrointestinal**
  - Nausea/Vomiting
  - Diarrhea
  - Abdominal Pain

- Consider MIS-C in any pediatric death with evidence of SARS-CoV-2 infection

MIS-C
Definition
shed May 14th

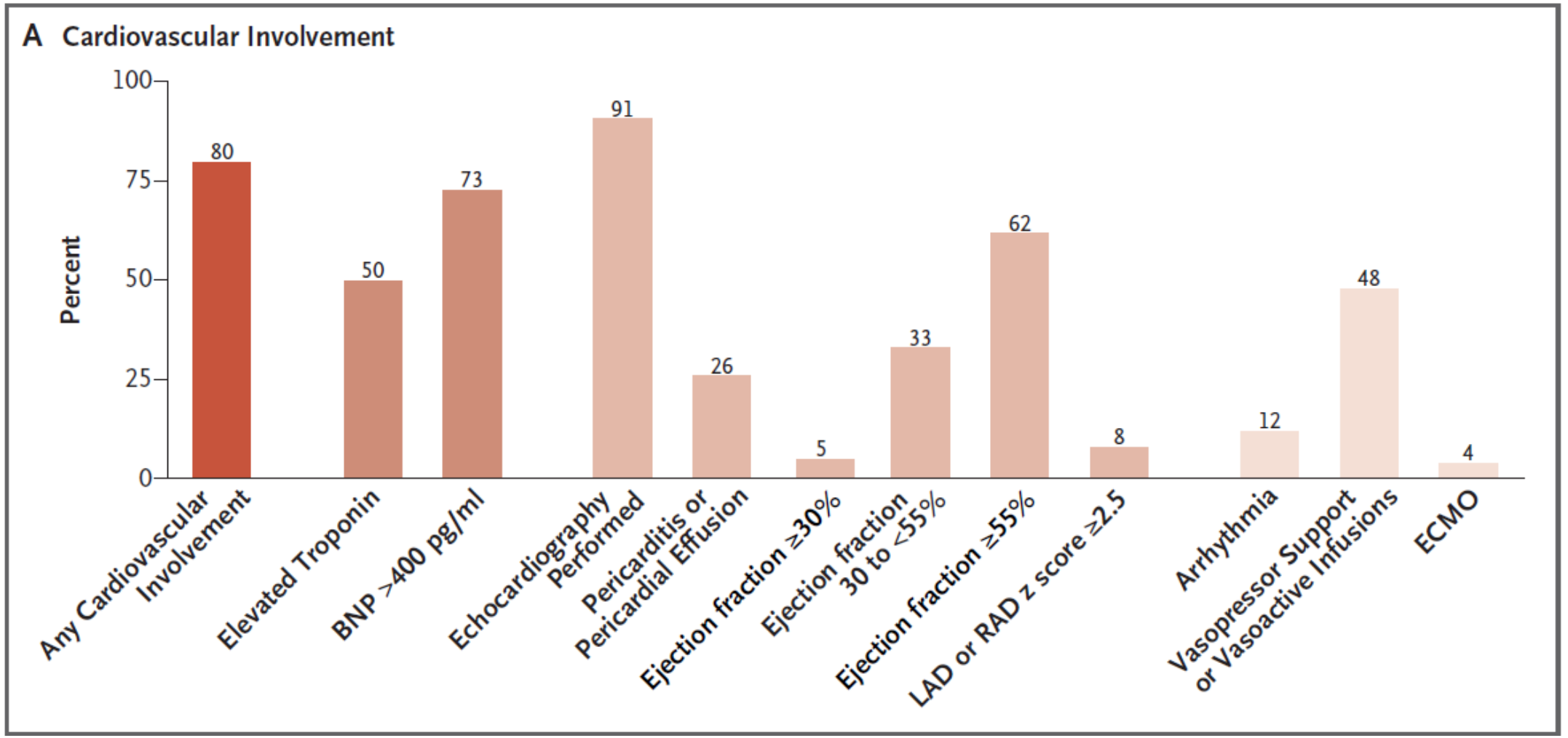
Various estations

- Refractory vaso function -like), with normal cardiac
- Septic and/or ca al dysfunction
- Kawasaki-like illı
- Some variations



McCrindle et al *Circ*. 2017;135(17)

Cardiac Manifestations in MIS-C



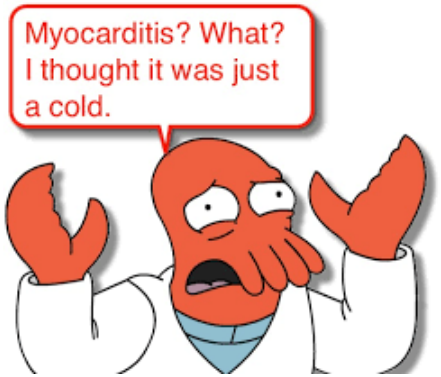
Randolph et al. *N Engl J Med*. 2020;383(4):334-346

Therapeutic Interventions for MIS-C

- Cardiovascular and Respiratory Support
  - Ionotropes, Mechanical Ventilation, ECMO
- Organ Specific Therapy
  - Dialysis
- Anticoagulation
  - Aspirin, Lovenox, Heparin
- Anti-inflammatory Medications
  - IVIG, Corticosteroids, Immunomodulators
- Antivirals
  - Remdesivir

Other Cardiac Manifestations COVID-19

- Multiple cardiovascular sequelae reported in COVID-19 may lead to or exacerbate current disease
- Most data available regarding impact of COVID-19 on cardiovascular system is from the adult population
  - Arrhythmias are more common in patients with severe disease and/or history of prior cardiac disease
  - Myocarditis may be present, with or without ventricular dysfunction
  - Heart failure, exacerbation of prior disease or new onset
  - Cardiogenic shock
- Susceptible pediatric cardiac populations may be at higher risk
  - Pediatric heart transplantation
  - Congenital heart disease



Susceptible Pediatric Cardiac Populations

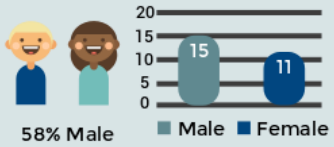
- Patients with severe congenital heart disease (CHD)
  - Given our knowledge regarding previous viruses, such as Influenza and Respiratory Syncytial Virus, it is reasonable to infer that children with severe congenital heart disease may have a higher risk of severe disease with COVID-19
  - The AHA/ACC guidelines (based on anatomic and physiologic classification) for the care of adults with CHD may be a useful tool in assessing the risk for COVID-19 in this population
  - Co-morbidities and other organ involvement in this population may also increase the risk of severe disease associated with COVID-19
- Pediatric Heart Transplantation
  - Pediatric transplant society guidelines
  - Assessment of protocols, guidelines and management strategies

Alsaied at al. *J Am Heart Assoc*. 2020;9(12)

Pediatric Heart Transplant Society

PHTS COVID-19 Dashboard

Gender



58% Male

Median Age at Diagnosis of COVID-19

8.13 years

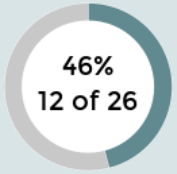
Time of Diagnosis

4	22
Pre Transplant	Post Transplant

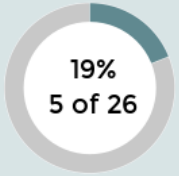
4	22
Presumed	Swab Positive

26
Total Cases

Hospitalized

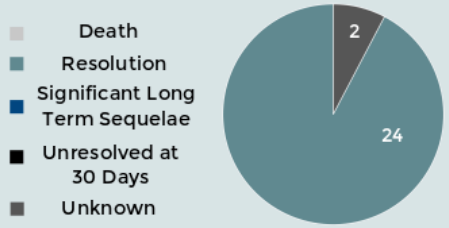


ICU



Ventilator

30 Day Outcome



Based on data reported to the PHTS registry by participating hospitals as of July 20, 2020.
For more information visit www.uab.edu/phts

www.uab.edu/phts

Recommendations

- Acute MIS-C management requires multidisciplinary collaboration
  - Cardiology, Infectious Disease, Immunology, Rheumatology, PICU/Pediatrics, ER
- **ALL** patients with MIS-C require cardiology follow-up, even in the presence of a normal echocardiogram or mild symptoms
  - Follow-up practices currently based on Kawasaki guidelines
  - At minimum, 2 weeks and 4 weeks post-discharge with echocardiograms
  - Inflammatory markers and other abnormal labs should be trended until normal
- Anti-coagulation with at least low dose ASA (5 mg/kg/day) recommended for all patients diagnosed with MIS-C, at least until cardiology follow-up
- If steroids were used for treatment then weaning over 2-3 weeks is recommended
- For patients who receive IVIg, live vaccines should be delayed for 11 months

McCrindle et al. *Circ*. 2017;135(17)

Other Cardiac Disease

- No changes to current cardiac medical therapy recommended if infected with COVID-19
- Social distancing, good hand hygiene and universal mask precautions recommended
- Utilize preventive strategies such screening for all patients prior to entrance into healthcare facilities
- Communicating all concerning symptoms, exposures or diagnoses to primary cardiac care team
- Triaging elective cases and visits, limiting provider and patient exposures (virtual visits when possible)

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- McCrindle BW, Rowley AH, Newburger JW, et al. Diagnosis, Treatment, and Long-Term Management of Kawasaki Disease: A Scientific Statement for Health Professionals From the American Heart Association [published correction appears in Circulation. 2019 Jul 30;140(5):e181-e184].
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COVID-19

Thank You

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COVID-19

Question & Answer

Cardiac Manifestations of COVID-19

Anuradha Lala-Trindade (Anu Lala) MD
Assistant Professor, Icahn School of Medicine at Mount Sinai
Director of HF Clinical Trials, Program Director AHFTC Fellowship
The Zena and Michael A. Wiener Cardiovascular Institute
Department of Health Population Science and Statistics

Cardiac Involvement in COVID-19

Circulation

IN DEPTH

COVID-19

Brief Report

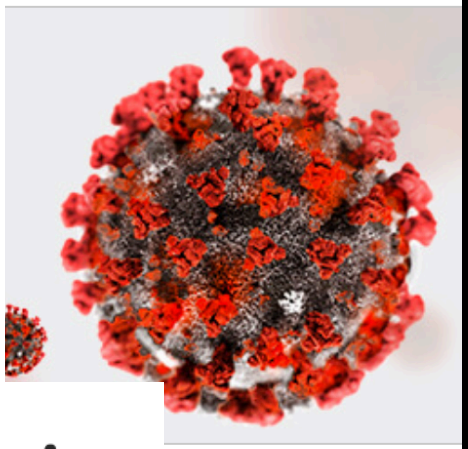
March 27, 2020

Cardiac Involvement in a Patient With Coronavirus Disease 2019 (COVID-19)

Riccardo M. Ir

COVID-19 and Cardiology

ONLINE FIRST FREE



New Evidence Co
ARBs in COVID-19

Does SARS-CoV-2 cause viral myocarditis in COVID-19 patients? FREE

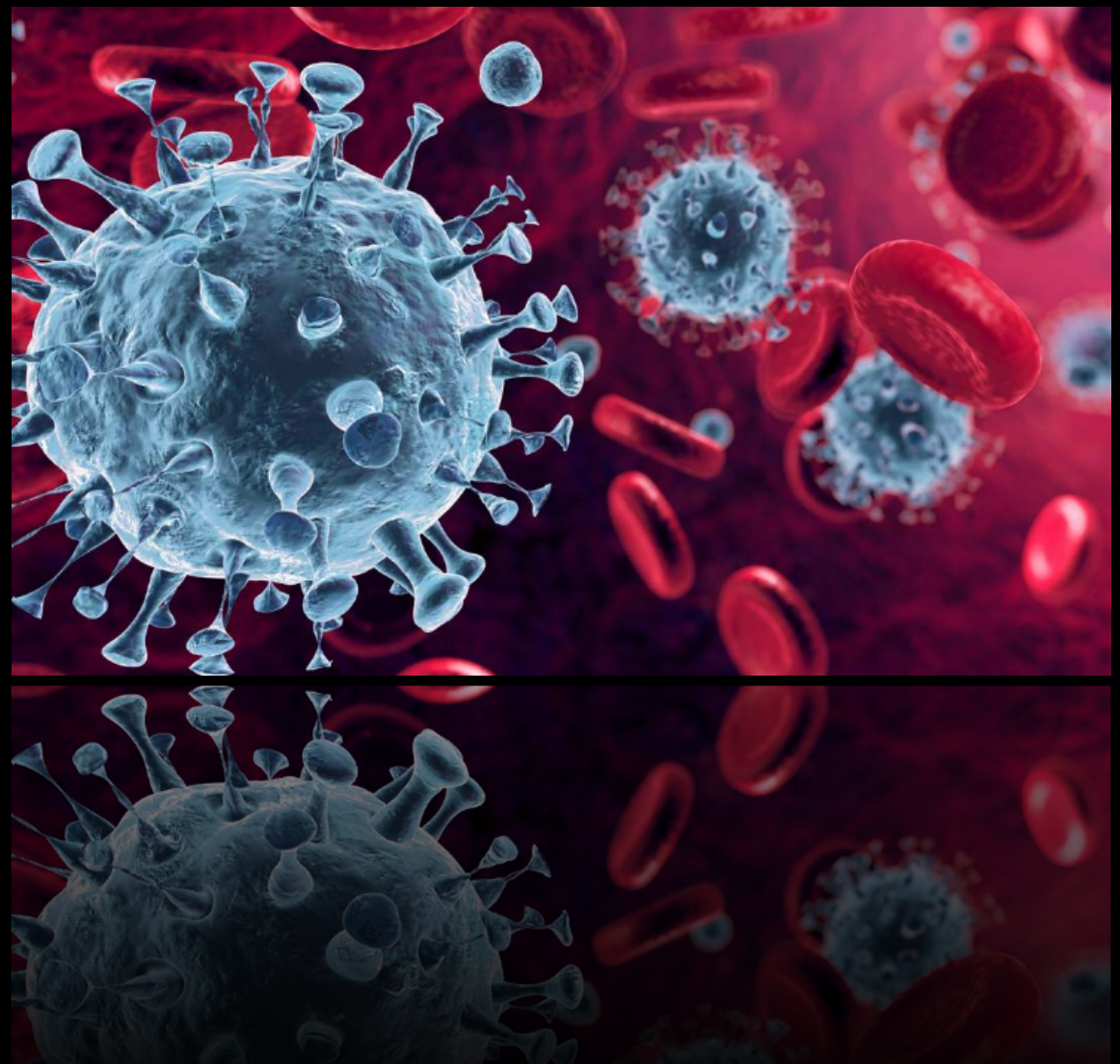
Ruihai Zhou

European Heart Journal, Volume 41, Issue 22, 7 June 2020, Page 2123,
https://doi.org/10.1093/eurheartj/ehaa392

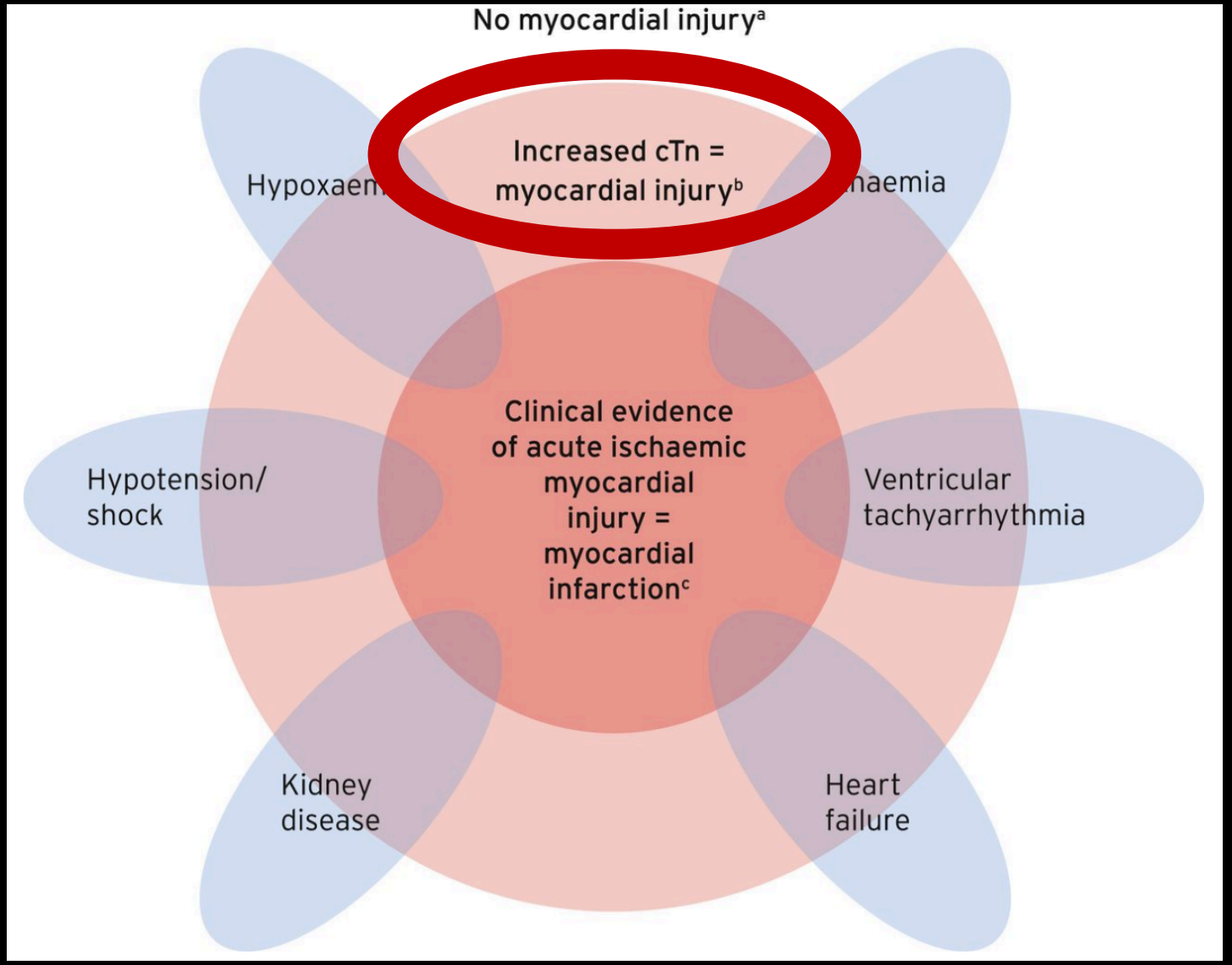
Published: 03 May 2020

Outline

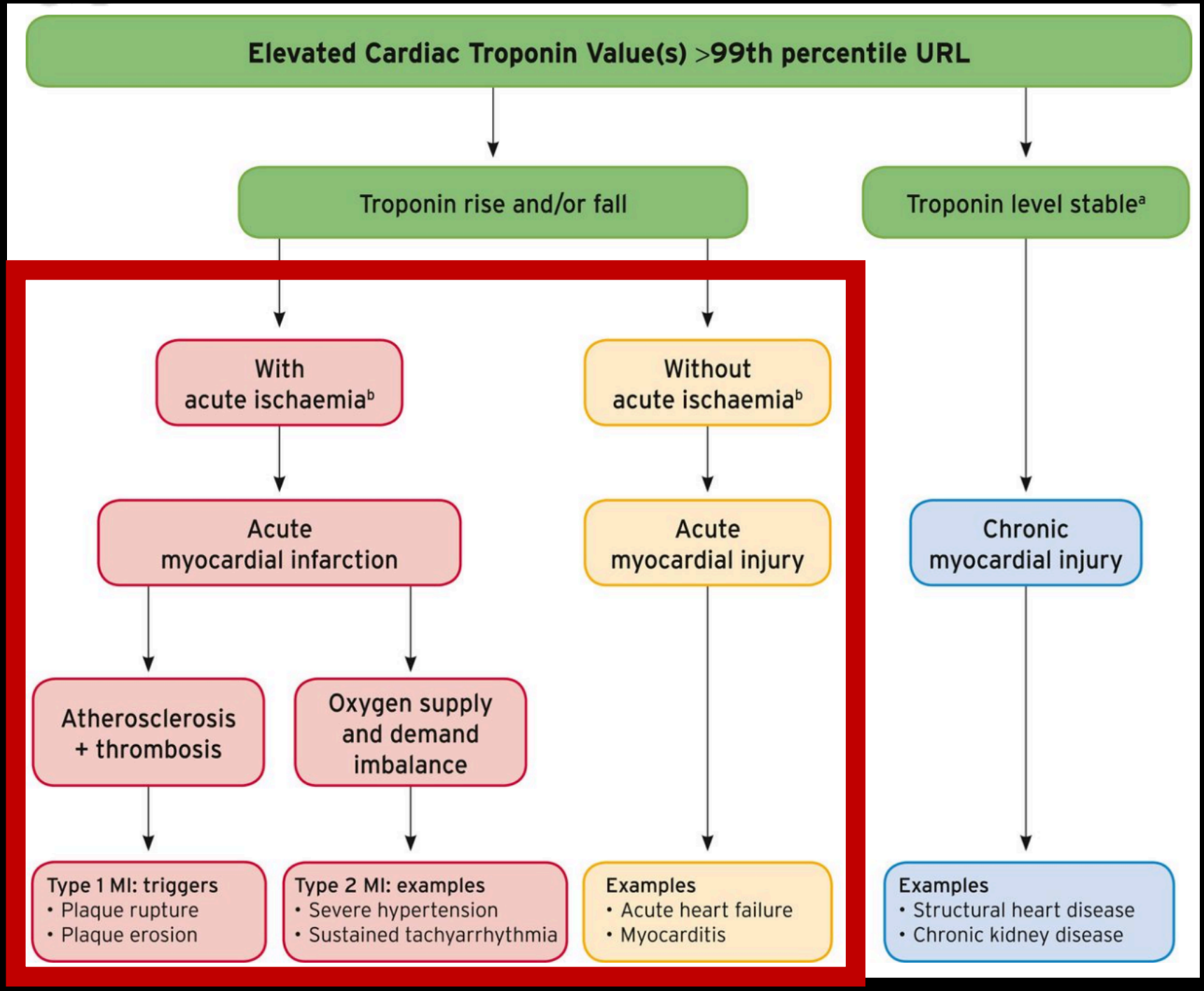
- Definition
- Mechanism
- Manifestations
- Prevalence
- Impact



DEFINITION: Increased Troponin = Myocardial injury

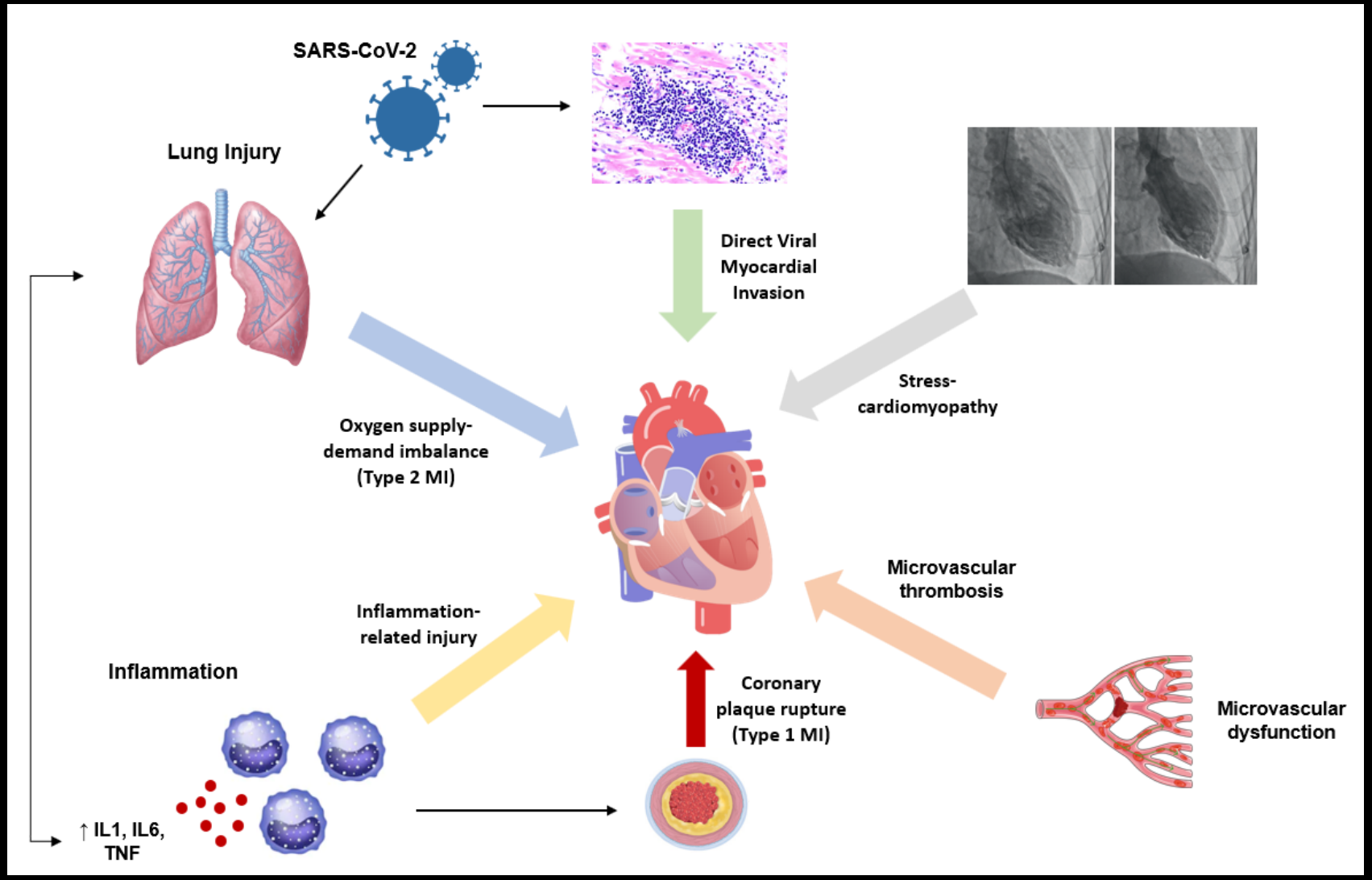


K Thygesen et al. JACC 2018



K Thygesen et al. JACC 2018

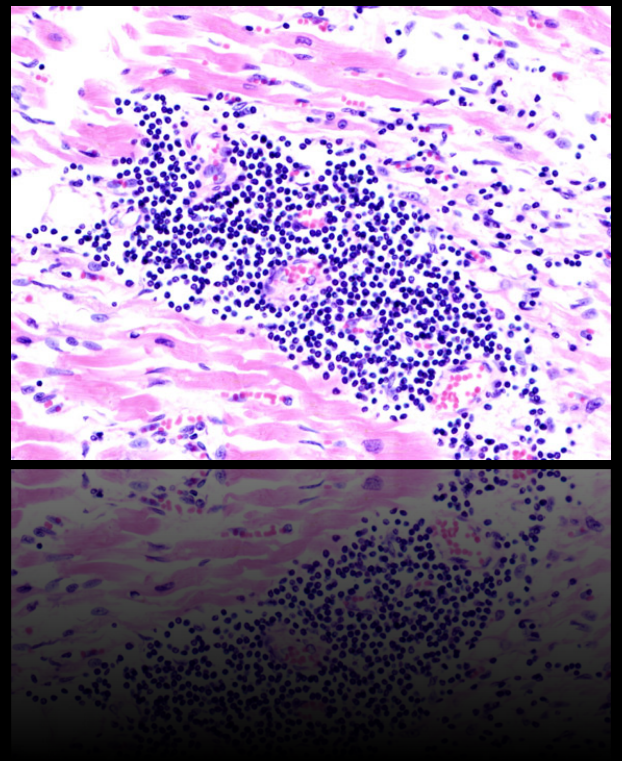
MECHANISMS of Myocardial Injury in COVID-19



Giustino, Pinney, Lala et al, *Under Review, JACC*

MANIFESTATIONS:
Does SARS-CoV-2 cause myocarditis?

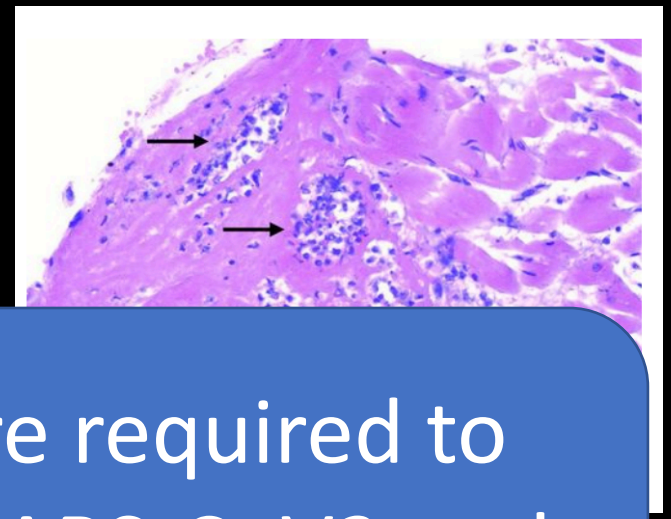
- COVID-19 myocarditis diagnosis requires:
  - Clinical presentation
    AND
  - Histologic findings
    - inflammatory lymphomonocytic infiltrates + myocyte necrosis not typical of ischemic injury
  - SARS-CoV-2 genome in heart tissue
  - Viral particles in cardiomyocytes
  - Exclusion of known cardiotropic viruses (enterovirus, parvovirus)
  - Troponin ≠ myocarditis

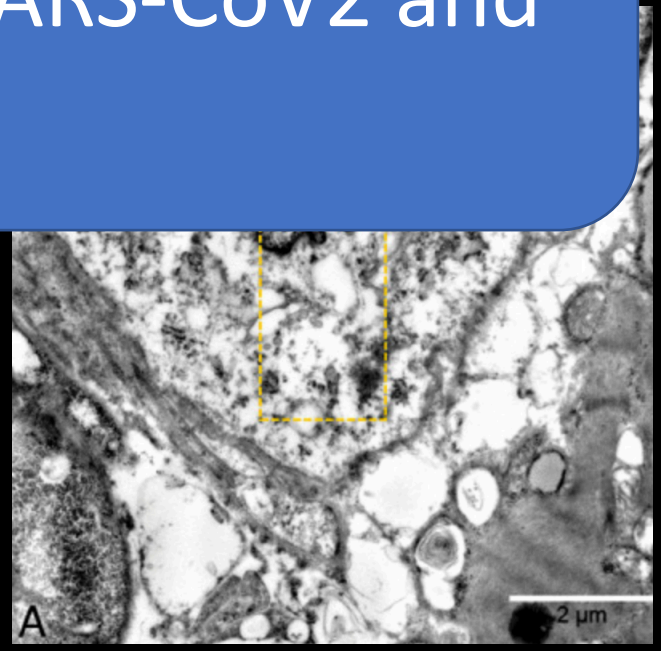


Caforio AL et al. Eur Heart J 2013

Autopsy and Case Reports

- Hamburg, Germany -12 patients
  - 11 Austria
  - 7 New York
  - 39 Germany SARS-CoV-2 in 24/39 pts, but NOT associated w/inflammatory cells
- Myocarditis Case Reports
  - Tavazzi – SARS-CoV-2 in macrophages but not myocytes

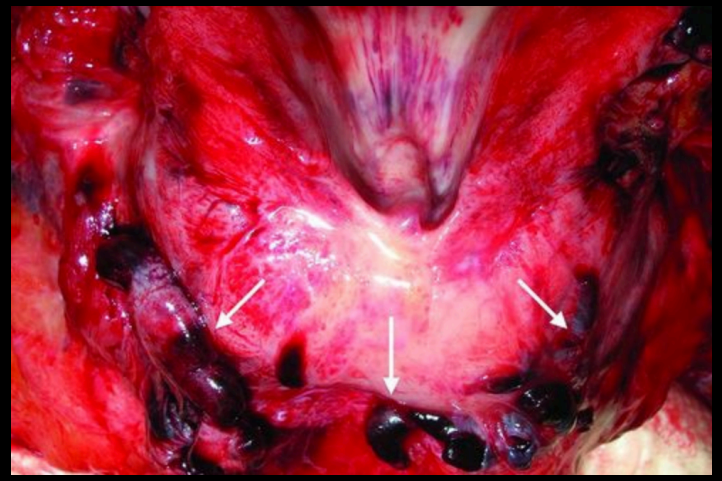


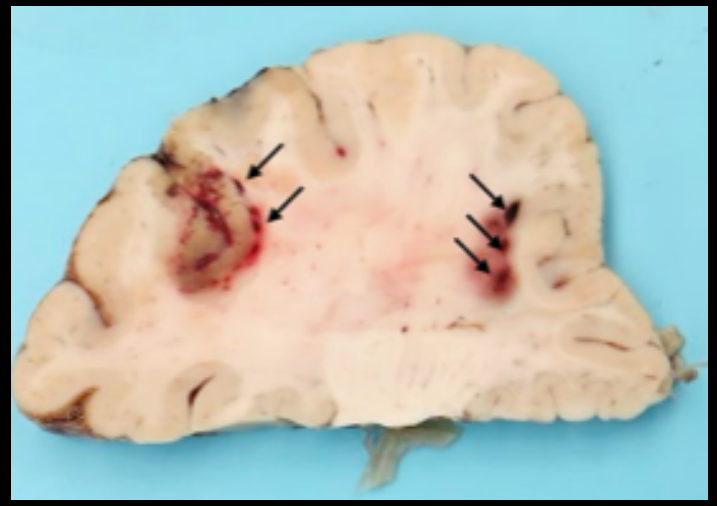


Further evidence (autopsy and biopsy) are required to confirm the causal relationship between SARS-CoV2 and Myocarditis

Wichmann et al. Ann Int Med 2020, Lax et al. Ann Int Med 2020; Reynolds Eclinical Med 2020; Xu et al. Lancet Resp Med 2020; Barton et al. Am J Clin Path 2020; Lindner et al. JAMA Cariol. 2020

MANIFESTATIONS: What about Thrombosis?

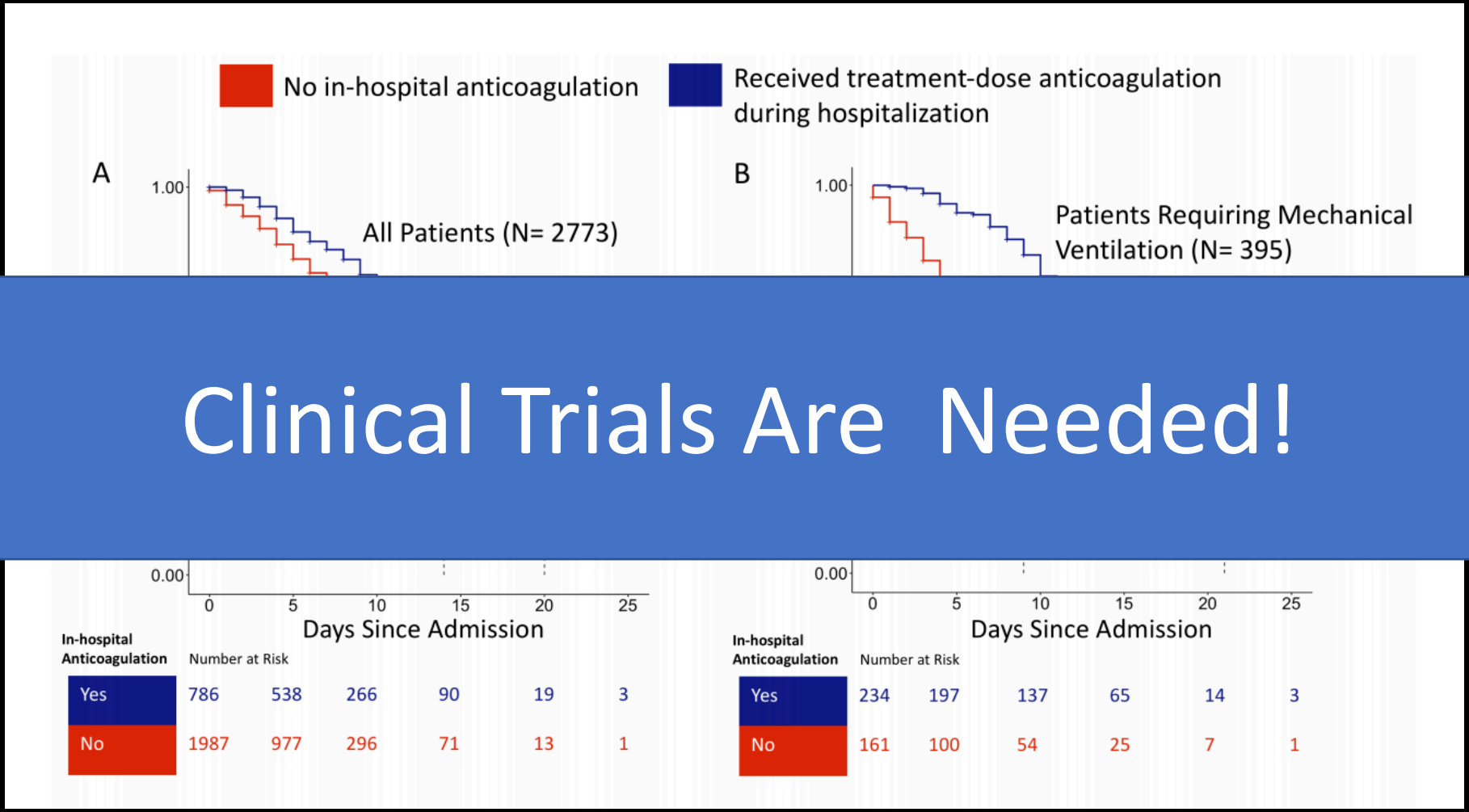




- VTE/Thrombosis appears to be common ~ 30% among inpatients
- Strokes among young patients
- Frequent post mortem findings of pulmonary emboli
- Post mortem findings of multivessel microthrombi

TJ Oxley NEJM 2020, Marongiu F, J Thromb Haemost 2020; Wichmann et al. Ann Int Med 2020

To Anticoagulate or Not to Anticoagulate?



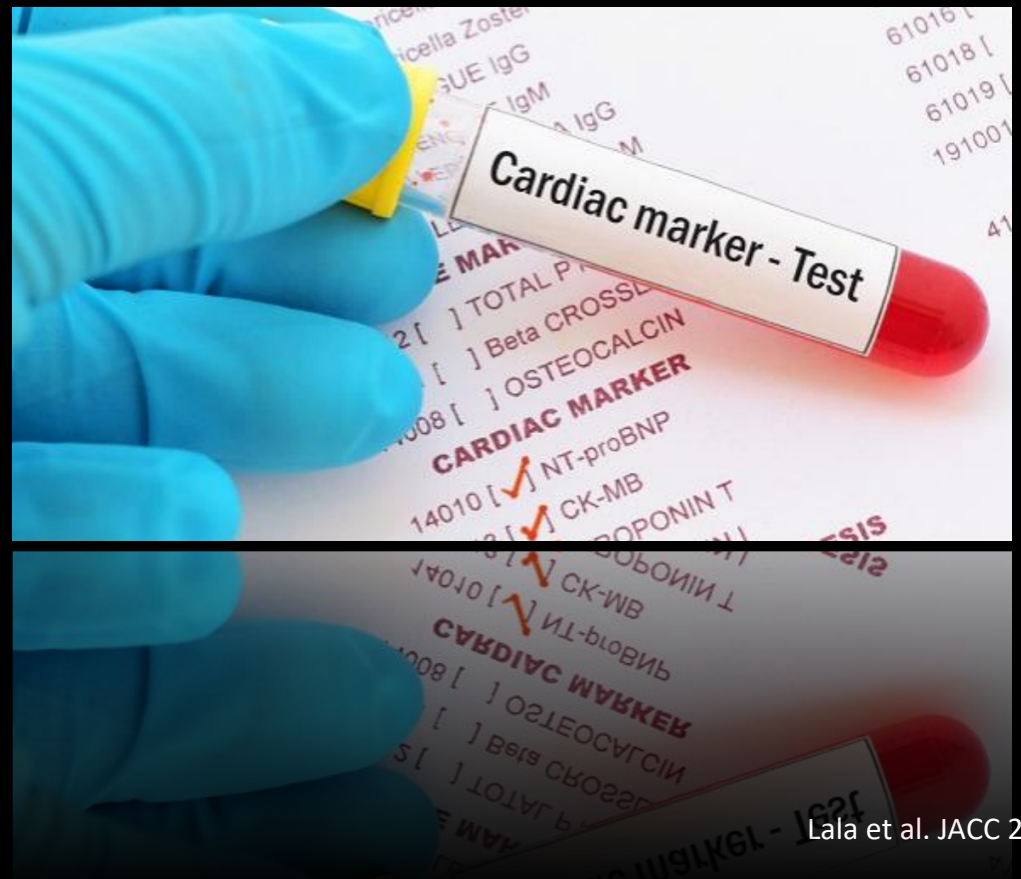
Clinical Trials Are Needed!

longer duration of AC treatment was associated with a reduced risk of mortality (adjusted HR of 0.86 per day, 95% confidence interval 0.82-0.89.

Paranjpe, Fuster, Lala et al JACC 2020

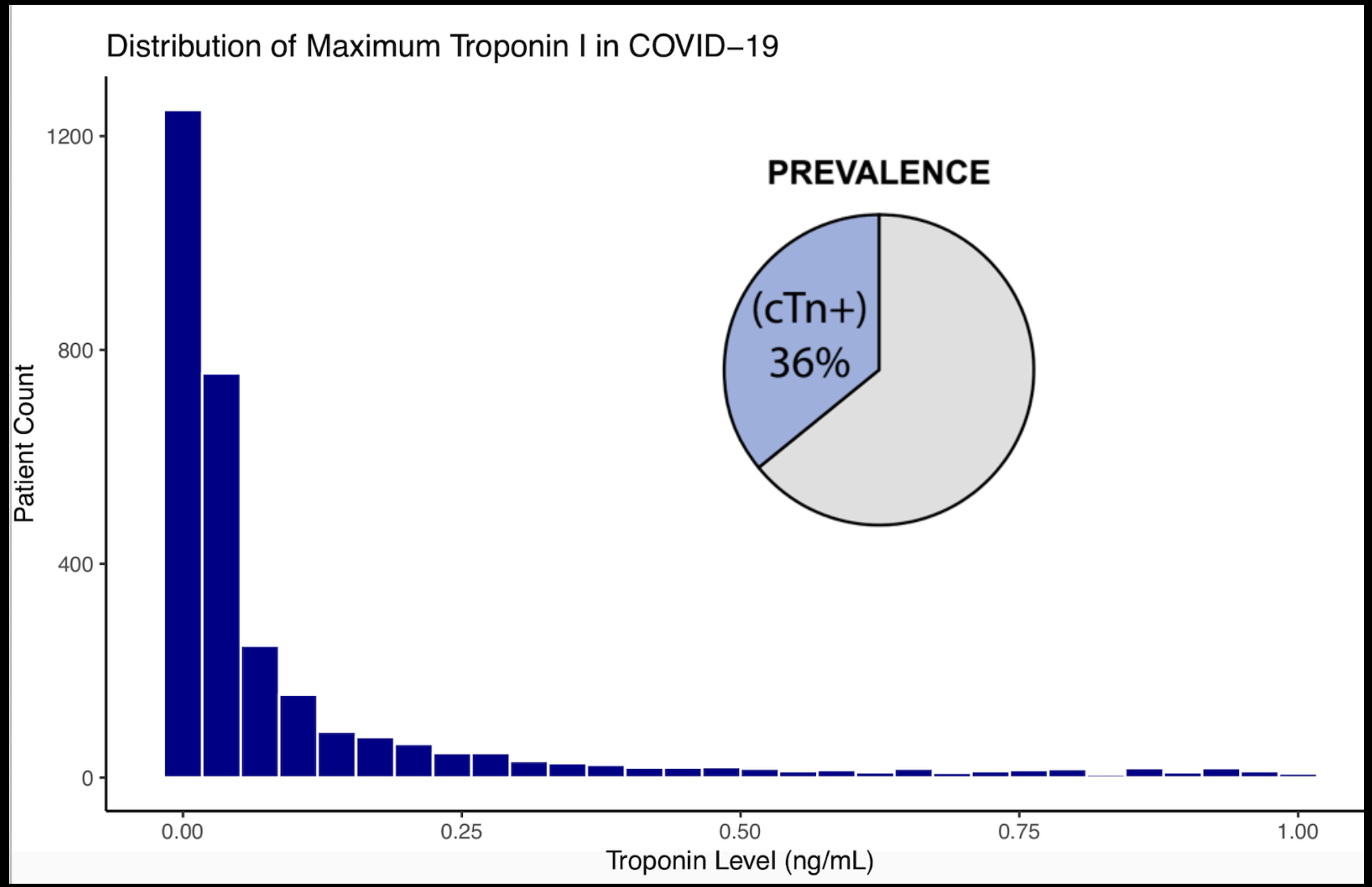
Prevalence and Impact of Myocardial Injury in Patients Hospitalized With COVID-19 Infection

- ~3000 hospitalized patients
- 25% AA, 27% Hispanic/Latino
- 25% with CVD
  - Afib, Heart Failure, or CAD
- 25% with HTN or DM
- 22% on ACE/ARB; 36% on statins



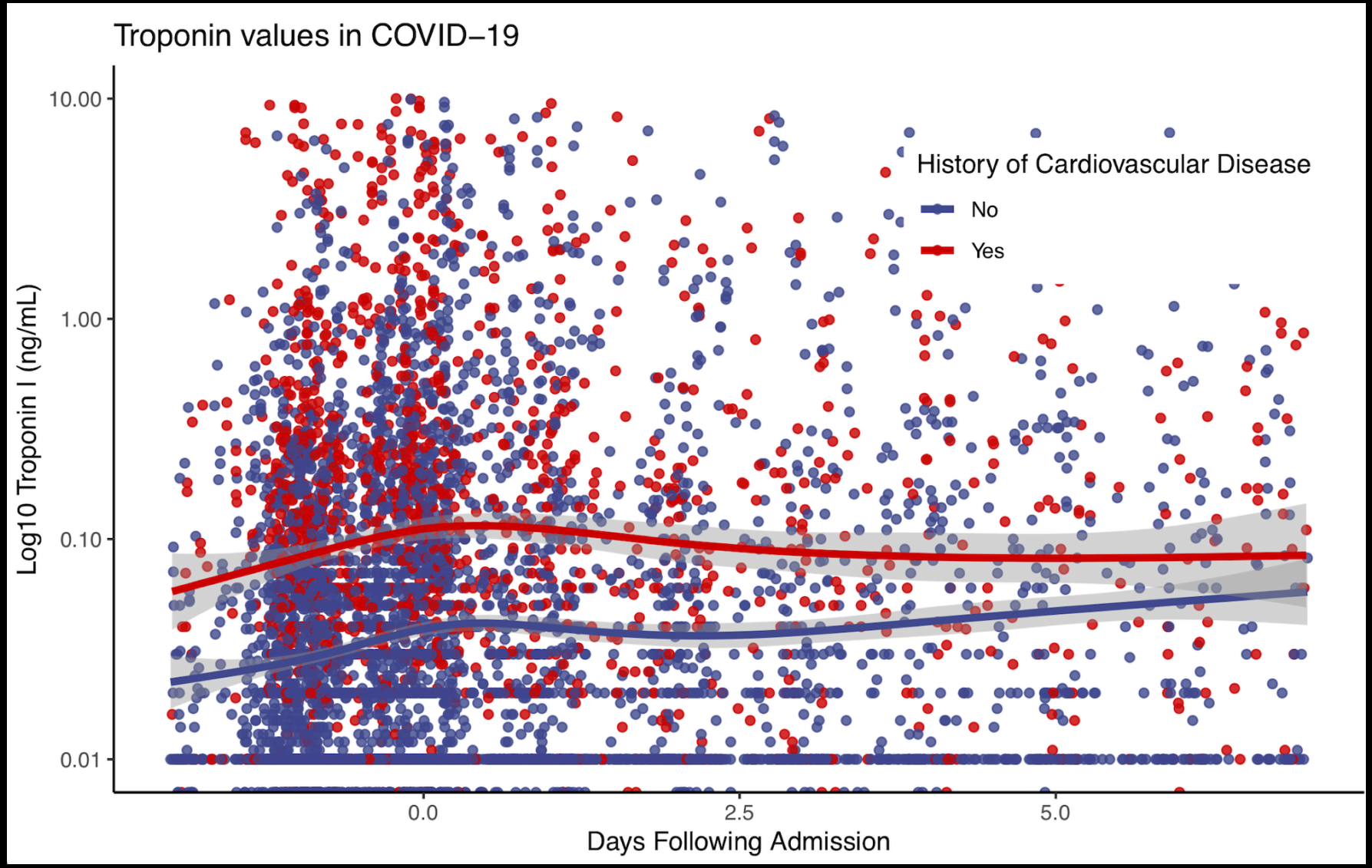
Lala et al. JACC 2020

PREVALENCE & Distribution of Troponin



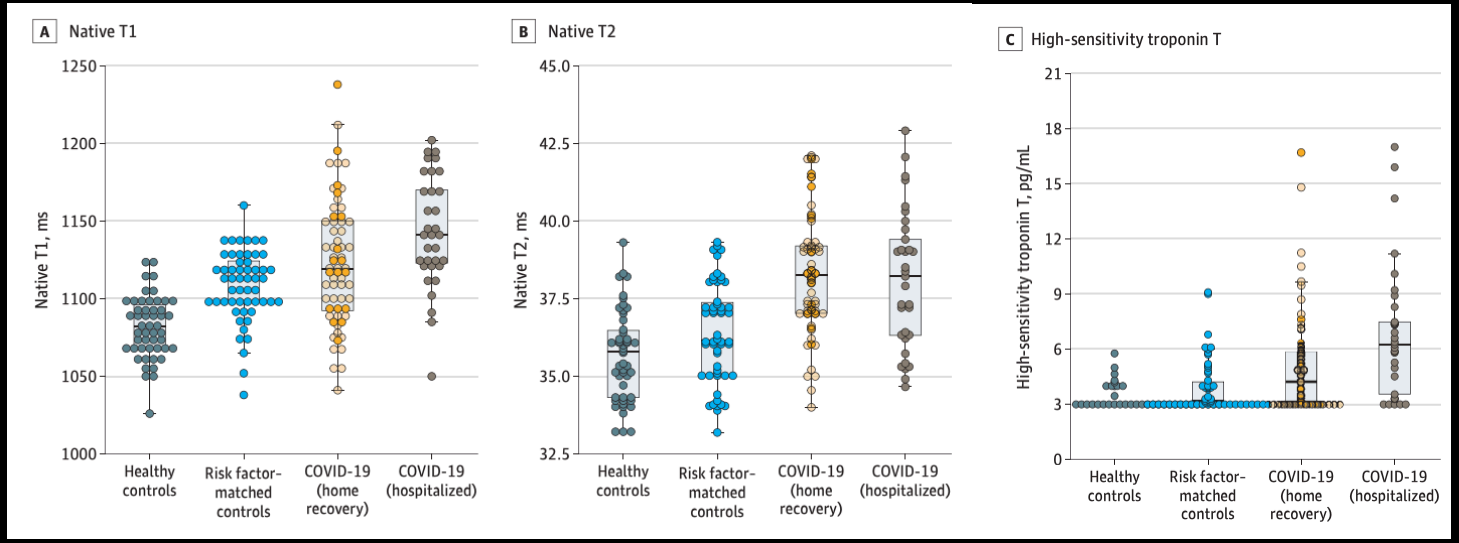
Lala et al. JACC 2020

Troponin by History of CVD



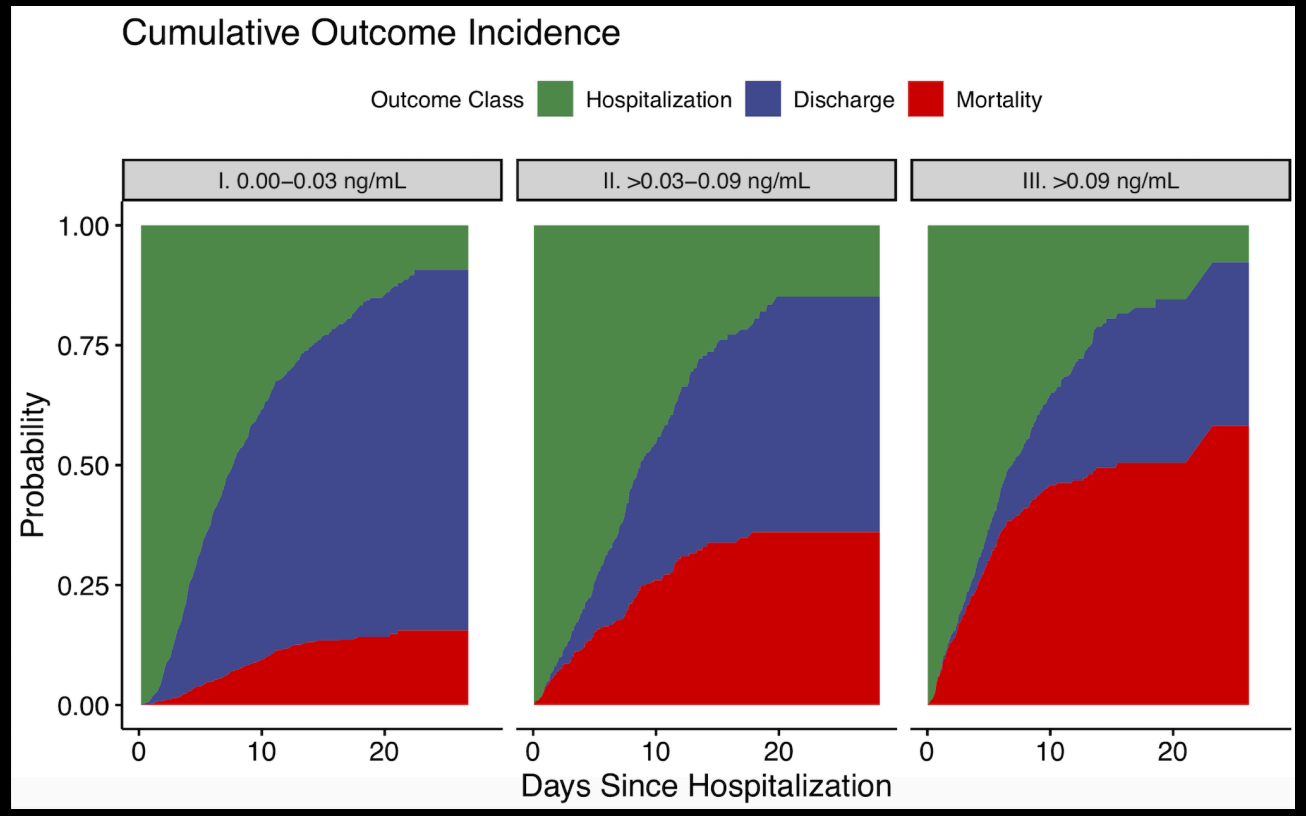
Lala et al. JACC 2020

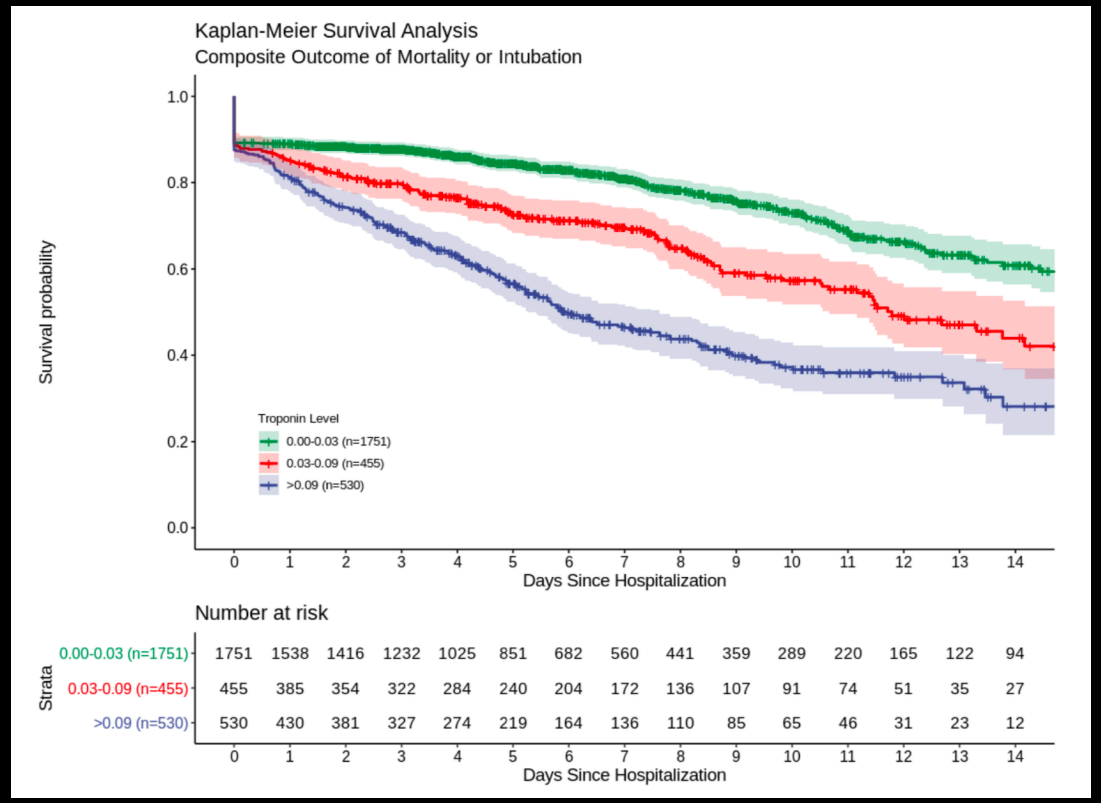
PREVALENCE: 78% patients recovered from COVID-19 had Cardiac Involvement on MRI



- 100 patients with recently recovered COVID-19 (mild-to moderate)
- Median time from COVID-19 testing to CMR was 71 days, mean age 49
- 2/3 recovered at home, 1/3 hospitalized
- 71% with elevated troponin
- 60% ONGOING inflammation

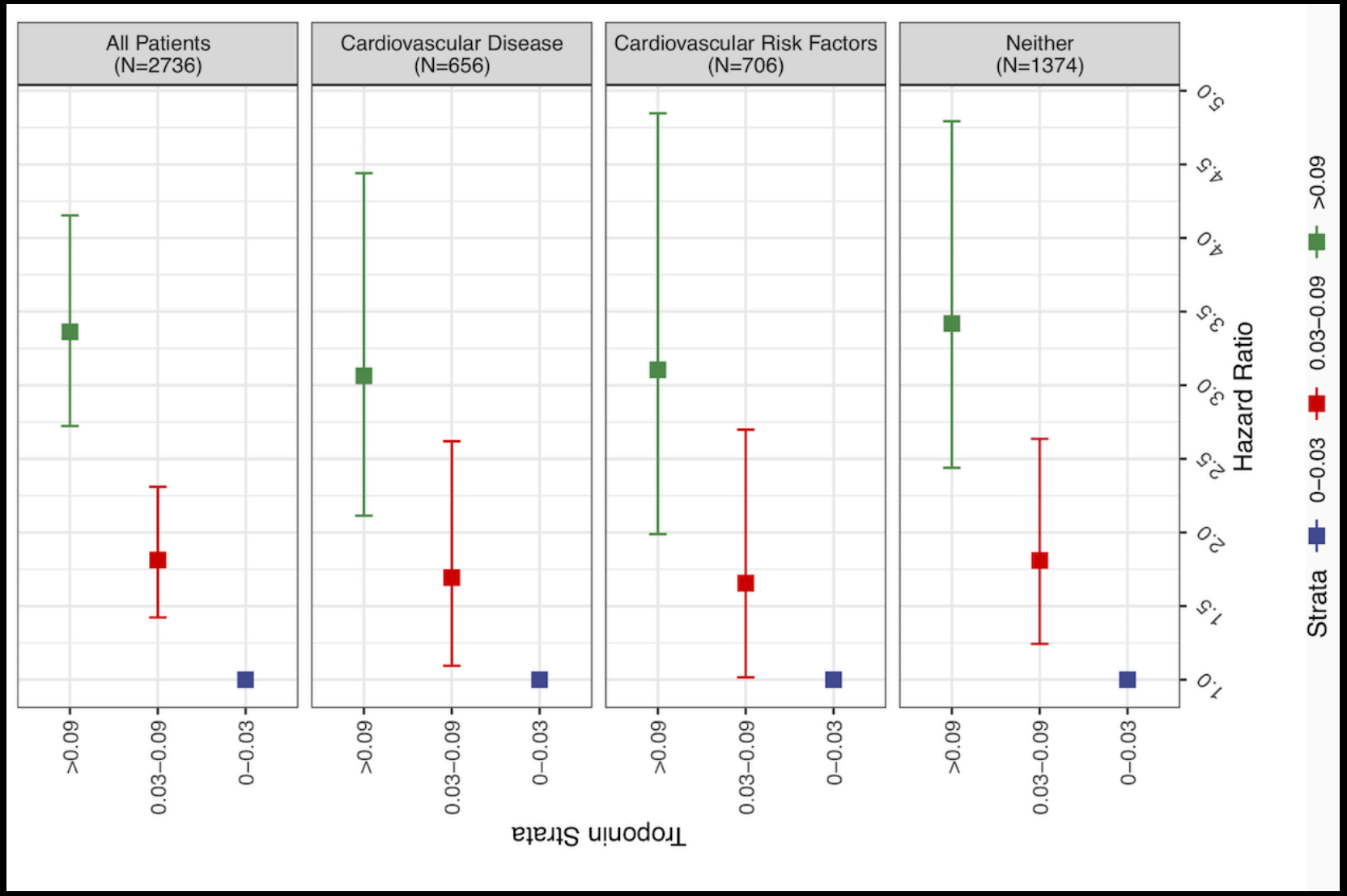
IMPACT: Discharge & Death By Troponin Levels





Lala et al. JACC 2020

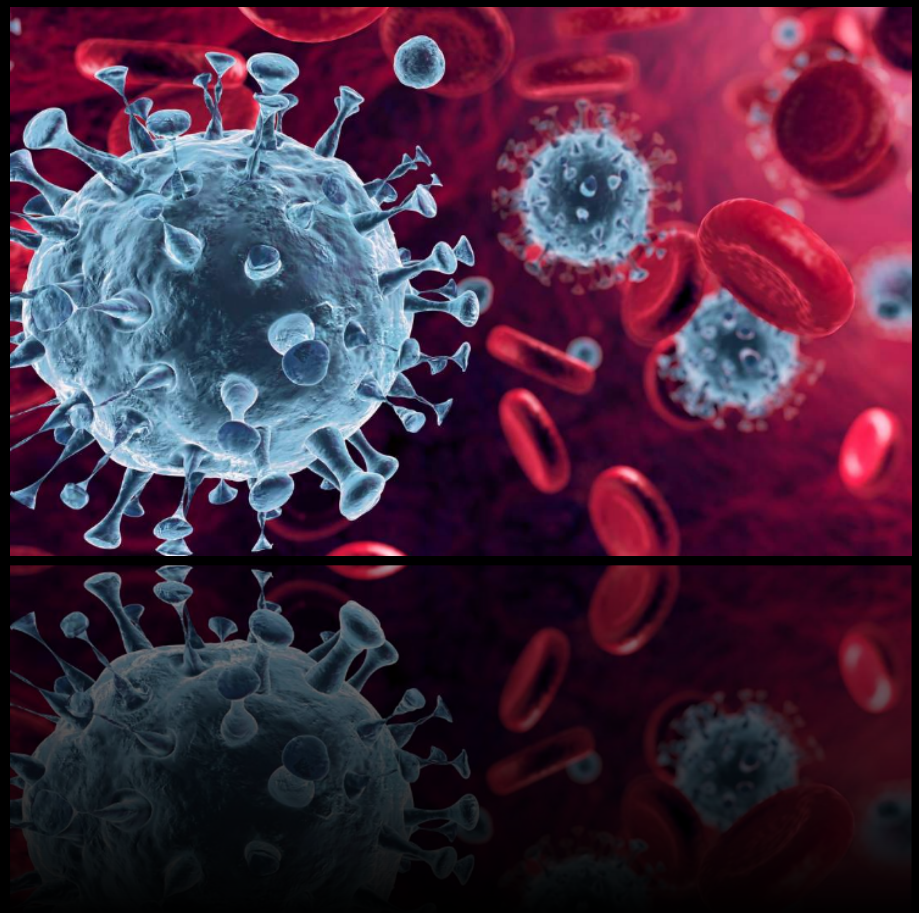
Troponin elevation more prognostic than CVD alone



Lala et al. JACC 2020

Take home points – Cardiac Involvement

- Definition
  - Myocardial injury = troponin elevation
- Mechanism
  - Remains unknown
- Manifestations
  - True SARS-CoV-2 myocarditis is rare
  - Thrombosis is likely an important complication
- Prevalence
  - Common
  - CMR involvement in recovered patients
- Impact
  - Marker of worse prognosis
  - Longitudinal follow up is needed



Mount Sinai Heart

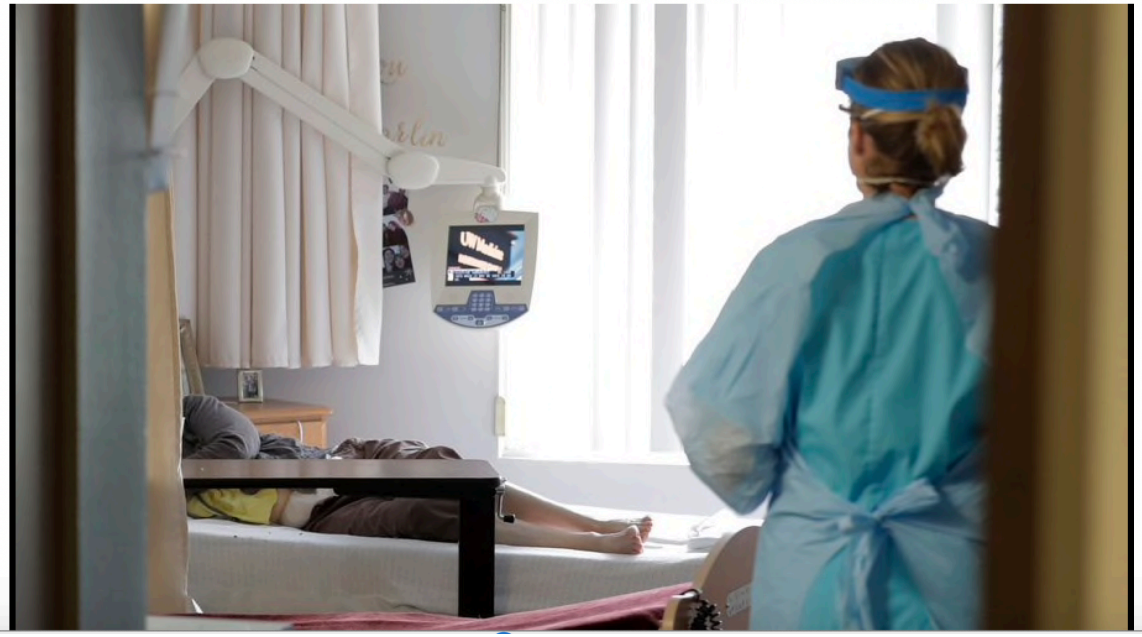
Thank you! Stay Strong & Stay Safe

AMERICAN COLLEGE of CARDIOLOGY

COVID-19

Question & Answer

What we know about the long term consequences of getting COVID-19



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Jerold B. Katz Investigator, Academy of Translational Research
Chief Division of CVF Prevention and Wellness
Houston Methodist DeBakey Heart & Vascular Center
Co-Director, Center for Outcomes Research

UNKNOWNS 1 MONTH AGO
RECOVERY FROM COVID-19

HOUSTON Methodist LEADING MEDICINE

A Surgeon's Survival Story: Five Phone Calls, a Long Recovery, and Lessons Learned from COVID

June 23, 2020 | by Guest Blogger

Despite the odds, Wu, who is 44 and has no serious underlying health conditions, did survive. Three months after his nearly fatal brush with COVID-19 began, lingering effects from his illness have prevented his full return to work. When he does get back into the operating room, it will be with a new perspective on the patient experience, honed by the challenges he has faced on his own long road to recovery.

In the weeks after leaving the hospital, Wu still tired easily and grew short of breath very quickly. Eventually he could make it up a flight of stairs, but he had to stop to catch his breath at the top. Although he slowly regained his strength, even now, two months later, he still uses oxygen to help him breathe at night. He often needs to pause to take an extra breath during a long conversation.

PERSISTENT SYMPTOMS NOT UNCOMMON
'DEEPLY FRUSTRATING'

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Dani Oliver
@DaniOliver

Hey, so, I got #Covid19 in March. I've been sick for over 3 months w/ severe respiratory, cardiovascular & neurological symptoms. I still have a fever. I've been incapacitated for nearly a season of my life. It's not enough to not die. You don't want to live thru this, either. 1/

Paul Garner Retweeted

IndiaSpend @IndiaSpend · Jul 24

"#COVID19 is weirder than any disease I have ever come across; lasts longer than any disease I have had," says British epidemiologist @PaulGarnerWoof, who is recovering from COVID19 and has had chronic malaria & dengue in the past. Our interview:

'COVID-19 Is Weirder, Lasts Longer Than Any Disease I Have Com...
COVID-19 is "weirder than any disease that I have ever come across, and it has gone on longer than any disease I have had," sa...
indiaspend.com

Neuroscientist Athena Akrami has had debilitating symptoms since her coronavirus infection more than 4 months ago.

MAJORITY OF HOSPITALIZED PATIENTS DON'T RECOVER IN 2 MONTHS

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Persistent Symptoms in Patients After Acute COVID-19

JAMA. Published online July 09, 2020. doi:10.1001/jama.2020.12603

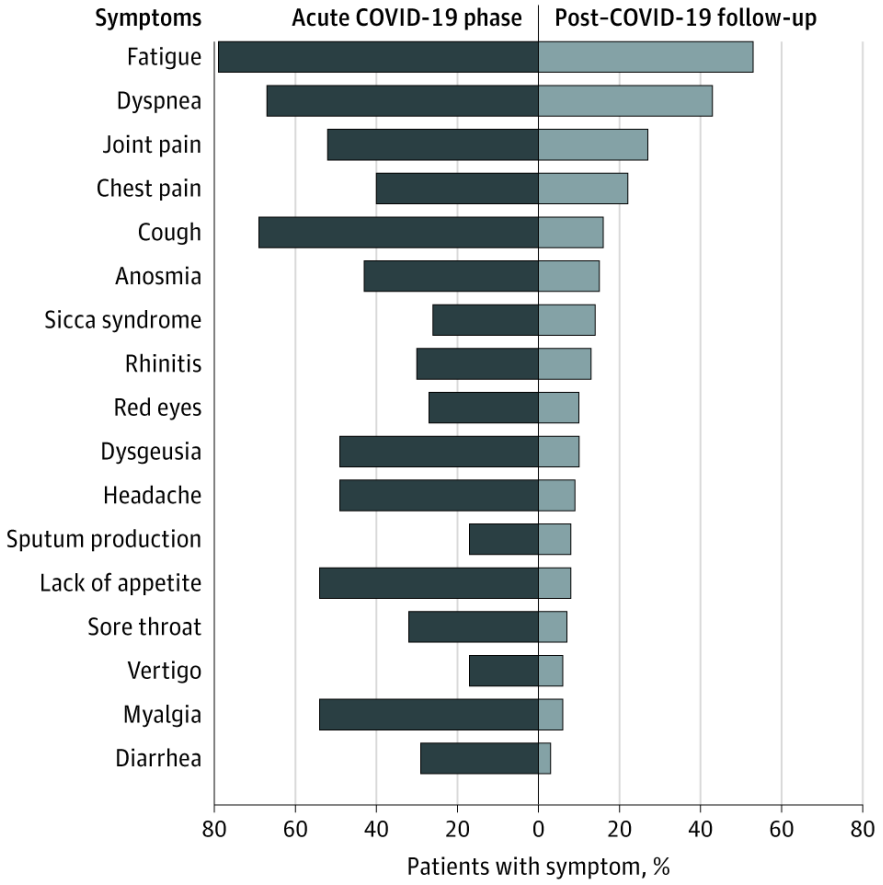
143 Patients Admitted with COVID-19

72% with PNA

2 Week LOS

2 Months post discharge

- **12% completely free of any COVID-19–related symptoms**
- **32% had 1-2 symptoms**
- **55% had 3 or more symptoms**



COVID-19 RESULT IN PROLONGED ILLNESS EVEN AMONG YOUNG ADULTS WITHOUT MEDICAL CONDITIONS

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EDITORS' PICK | 167,985 views | Jun 13, 2020, 07:09am EDT

Report Suggests Some 'Mildly Symptomatic' Covid-19 Patients Endure Serious Long-Term Effects

Forbes

1,622 Covid-19

91% of the patients not hospitalized

88% persistent intense fatigue
75% shortness of breath
45% chest pressure
40% headache
36% muscle

Post Covid-19: Only 6% consider themselves healthy

BREAKING | 22,308 views | Jul 24, 2020, 05:18pm EDT

35% Of U.S. Adults Still Have Symptoms Of Covid-19 Two To Three Weeks After Testing Positive, CDC Study Finds

Matt Perez Forbes Staff
Innovation
I cover breaking news.

Risk for Delay in Recovery

Elderly
Women
Hypertension
Obesity
Kidney Disease

57% with 2 Chronic Conditions Not Recovered in 3 weeks

WHY PROLONGED SYMPTOMS WITH COVID-19?

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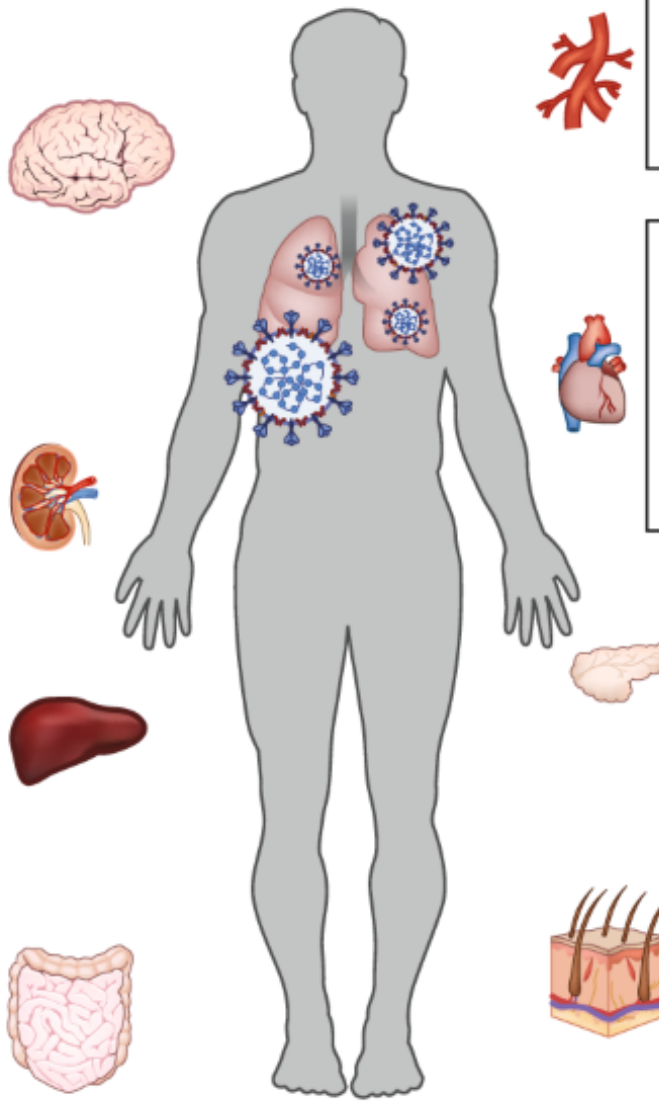
Neurologic
Headaches
Dizziness
Encephalopathy
Guillain-Barré
Ageusia
Myalgia
Anosmia
Stroke

Renal
Acute kidney injury
Proteinuria
Hematuria

Hepatic
Elevated aminotransferases
Elevated bilirubin

Gastrointestinal
Diarrhea
Nausea/vomiting
Abdominal pain
Anorexia



Thromboembolism
Deep vein thrombosis
Pulmonary embolism
Catheter-related thrombosis

Cardiac
Takotsubo cardiomyopathy
Myocardial injury/myocarditis
Cardiac arrhythmias
Cardiogenic shock
Myocardial ischemia
Acute cor pulmonale

Endocrine
Hyperglycemia
Diabetic ketoacidosis

Dermatological
Petechaie
Livedo reticularis
Erythematous rash
Urticaria
Vesicles
Pernio-like lesions

COVID-19 AUTOPSIES
MICROTHROMBI & LITTLE INFLAMMATION

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Research Paper

Megakaryocytes and platelet-fibrin thrombi characterize multi-organ thrombosis at autopsy in COVID-19: A case series

Fibrin microthrombi within cardiac microvasculature
Little myocardial inflammatory infiltrate

Brief Report

ONLINE FIRST FREE

July 27, 2020

Association of Cardiac Infection With SARS-CoV-2 in Confirmed COVID-19 Autopsy Cases

Majority (61%) autopsies revealed evidence of SARS-CoV2 in the heart
No increased inflammatory cells

CARDIAC DYSFUNCTION
LEFT vs RIGHT VENTRICLE INVOLVEMENT?

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Circulation
Volume 142, Issue 4, 28 July 2020, Pages 342-353
https://doi.org/10.1161/CIRCULATIONAHA.120.047971

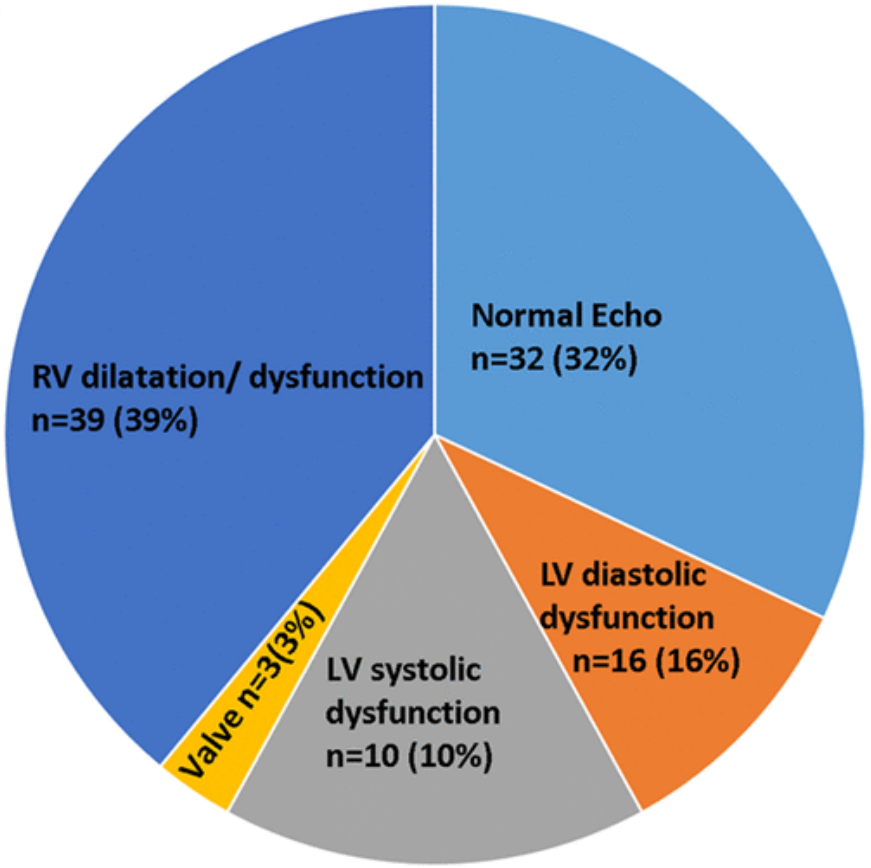
American Heart Association.

ORIGINAL RESEARCH ARTICLE

Spectrum of Cardiac Manifestations in COVID-19

A Systematic Echocardiographic Study

100 patients
Systolic LV dysfunction <10%
RV dilation & dysfunction most common



ST ELEVATION IN COV-19 THROMBO-EMBOLIC PHENOMEN?

HOUSTON Methodist LEADING MEDICINE

Circulation
Volume 141, Issue 25, 23 June 2020;, Pages 2113-2116
https://doi.org/10.1161/CIRCULATIONAHA.120.047525

American Heart Association.

RESEARCH LETTER

ST-Elevation Myocardial Infarction in Patients With COVID-19

Clinical and Angiographic Outcomes

40% absent culprit lesions

The NEW ENGLAND JOURNAL of MEDICINE

ST-Segment Elevation in Patients with Covid-19 — A Case Series

100% patients with elevated d-dimer levels

CARDIAC DAMAGE IN COVID-19 RECOVERY

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Original Investigation

ONLINE FIRST

July 27, 2020

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

Valentina O. Puntmann, MD, PhD[1]; M. Ludovica Carerj, MD[1,2]; Imke Wieters, MD[3]; et al

78/100 of patients had detectable hs-TnT 2-3 months in recovery

Raised T1 (n = 73), Raised T2 (n = 60), Late gadolinium enhancement (n = 32), pericardial enhancement (n = 22).

HEART FAILURE PANDEMIC?

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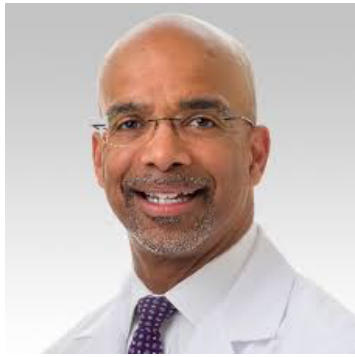
Editorial

ONLINE FIRST FREE

July 27, 2020

Coronavirus Disease 2019 (COVID-19) and the Heart—Is Heart Failure the Next Chapter?



"…crisis of COVID-19 will not abate but will instead shift to a new de novo incidence of heart failure and other chronic cardiovascular complications"

ITS NOT JUST THE HEART

HOUSTON Methodist LEADING MEDICINE

Research | Open Access | Published: 29 June 2020

Impact of coronavirus disease 2019 on pulmonary function in early convalescence phase

Yiying Huang, Cuiyan Tan, Jian Wu, Meizhu Chen, Zhenguo Wang, Liyun Luo, Xiaorong Zhou, Xinran Liu, Xiaoling Huang, Shican Yuan, Chaolin Chen, Fen Gao, Jin Huang, Hong Shan & Jing Liu

Respiratory Research **21**, Article number: 163 (2020) | Cite this article

1 in 2 abnormal CT findings.
3 in 4 with abnormal lung function
1 in 4 with severe disease had lung fibrosis

www.kidney-international.org clinical investigation

Acute kidney injury in patients hospitalized with COVID-19

Check for updates

37% with acute kidney damage
1 in 6 require dialysis (exclusively who required ventilation)

Most Hospitalized COVID Patients Have Neurologic Symptoms

— Severe complications seen in all stages of COVID-19, including recovery

1 in 2 with neurological symptoms
1 in 5 with disorders of consciousness
1 in 25 cause of death
7 fold increase risk of stroke vs influenza

Cerebral Micro-Structural Changes in COVID-19 Patients – An MRI-based 3-month Follow-up Study

Yiping Lu, MD[a,1], Xuanxuan Li, MD[a,1], Daoying Geng, MD, Prof[a,1], Nan Mei, MD[a,1], Pu-Yeh Wu, PhD[b], Chu-Chung Huang, PhD[c], Tianye Jia, PhD[d], Yajing Zhao, MD[a], Dongdong Wang, MD[a], Anling Xiao, MD, Prof[e,**], Bo Yin, PhD, Prof[a,*]

[a] *Department of Radiology, Huashan Hospital, Fudan University, Shanghai, China (Y Lu, X Li, D Geng, N Mei, Y Zhao, D Wang, B Yin)*
[b] *GE Healthcare, MR Research China, Beijing, China (P Wu)*
[c] *Institute of Cognitive Neuroscience, School of Psychology and Cognitive Science, East China Normal University, Shanghai, China (C Huang)*
[d] *Institute of Psychiatry, Psychology & Neuroscience, King's College London, London, England (T Jia)*
[e] *Department of Radiology, Fu Yang No.2 Hospital, Anhui, China (A Xiao)*

Majority with disruption to micro-structural and functional brain integrity

OUR EXPERIENCE WITH OTHER CORONAVIRUSES HAVE FOREWARNED US OF THESE PROBLEMS

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BMC Neurology

BMC Neurol. 2011; 11: 37.
Published online 2011 Mar 24. doi: 10.1186/1471-2377-11-37
PMCID: PMC3071317
PMID: 21435231

Chronic widespread musculoskeletal pain, fatigue, depression and disordered sleep in chronic post-SARS syndrome; a case-controlled study

85% with sleep disturbance, chronic fatigue, depression and muscle pains common
1 in 3 had to modify their work and lifestyle

Psychiatry Investig. 2019 Jan; 16(1): 59–64.
Published online 2019 Jan 7. doi: 10.30773/pi.2018.10.22.3
PMCID: PMC6354037
PMID: 30605995

Depression as a Mediator of Chronic Fatigue and Post-Traumatic Stress Symptoms in Middle East Respiratory Syndrome Survivors

1 in 2 with chronic fatigue at year 2
1 in 4 with clinically relevant depressive symptoms

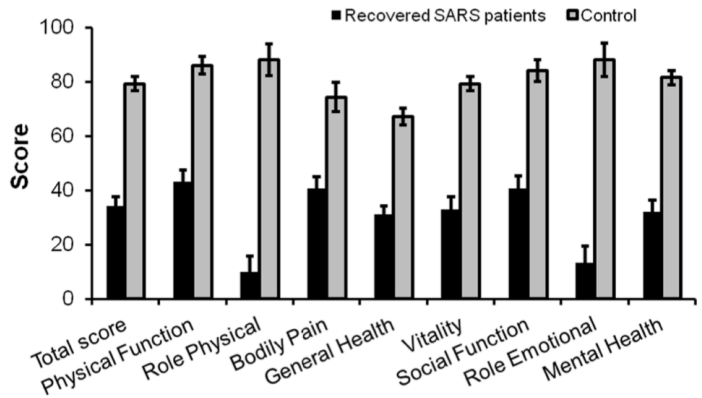
RESEARCH ARTICLE

Pulmonary Function and Clinical Manifestations of Patients Infected with Mild Influenza A Virus Subtype H1N1: A One-Year Follow-Up

PLOS ONE

1 in 2 with severe abnormal lung function
1 in 4 with normal lung function decreased ability to perform general physical activities

Altered Lipid Metabolism in Recovered SARS Patients Twelve Years after Infection



BLINDSPOT IN COVID-19 MANAGEMENT
"DISPARITIES"

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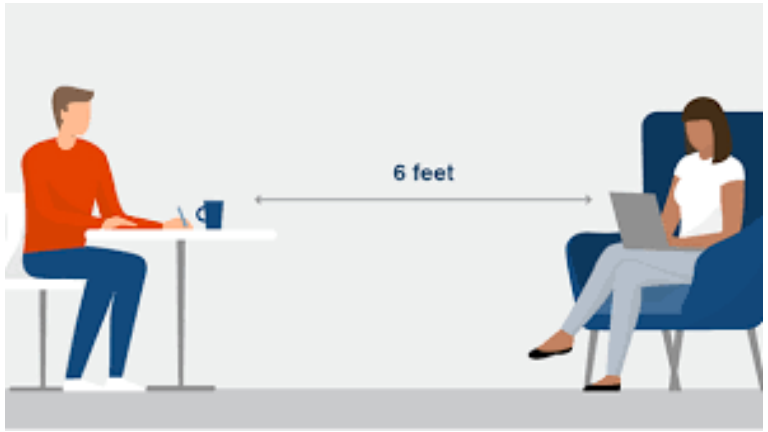

"Social Distancing is a Privilege"

BIGGEST UNKNOWN UNKNOWNS
DISPARITIES IN RECOVERY

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Even in Wealthy Areas of the U.S., People of Color Are More Likely to Get and Die from Coronavirus, Study Says

Social Determinants of Health

Economic Stability	Neighborhood and Physical Environment	Education	Food	Community and Social Context	Health Care System
Employment	Housing	Literacy	Hunger	Social integration	Health coverage
Income	Transportation	Language	Access to healthy options	Support systems	Provider availability
Expenses	Safety	Early childhood education		Community engagement	Provider linguistic and cultural competency
Debt	Parks	Vocational training		Discrimination	Quality of care
Medical bills	Playgrounds	Higher education		Stress	
Support	Walkability				
	Zip code / geography				

Health Outcomes
Mortality, Morbidity, Life Expectancy, Health Care Expenditures, Health Status, Functional Limitations

COVID-19 RECOVERY
MUCH TO LEARN & WORK STILL TO DO

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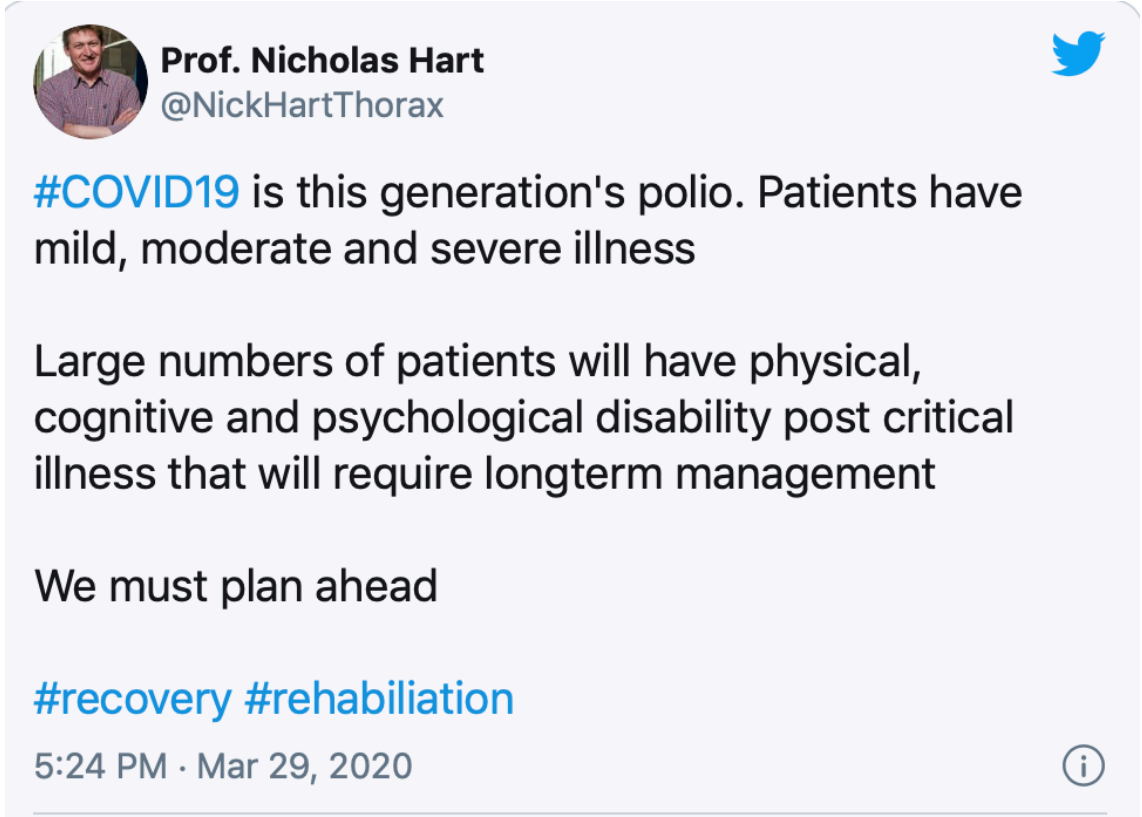
Prognosis

Virus Survivors Could Suffer Severe Health Effects for Years

Bloomberg

By Lisa Du
May 12, 2020, 4:00 PM CDT



UNDERSTANDING COVID-19 RECOVERY POTENTIAL ROADMAP

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INTEGRATED COVID CLINICAL AND RESEARCH PROGRAM

- **SURVEYS**
  - RECOVERY
  - SDOH
  - QUALITY OF LIFE
- **COVID RECOVERY CLINIC**
  - LUNG FUNCTION
  - COGNITIVE TESTING
  - IMAGING(LUNG/HEART/BRAIN)
- **BIOBANKING**

COLLABORATIVE PARTNERSHIP AMONG NATIONAL INSTITUTIONS

AMERICAN COLLEGE of CARDIOLOGY

COVID-19

Question & Answer

AMERICAN COLLEGE of CARDIOLOGY

COVID-19

Panel Discussion

AMERICAN
COLLEGE *of*
CARDIOLOGY

COVID-19