

# Complicaciones cardíacas por Covid-19

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# Association of Cardiac Injury With Mortality in Hospitalized Patients With COVID-19 in Wuhan, China

Shaobo Shi, MD; Mu Qin, MD; Bo Shen, MD; Yuli Cai, MD; Tao Liu, MD; Fan Yang, MD; Wei Gong, MMSC; Xu Liu, MD, PhD; Jinjun Liang, MD, PhD; Qinyan Zhao, MD, PhD; He Huang, MD, PhD; Bo Yang, MD, PhD; Congxin Huang, MD, PhD

Figure 1. Flowchart of Patient Recruitment

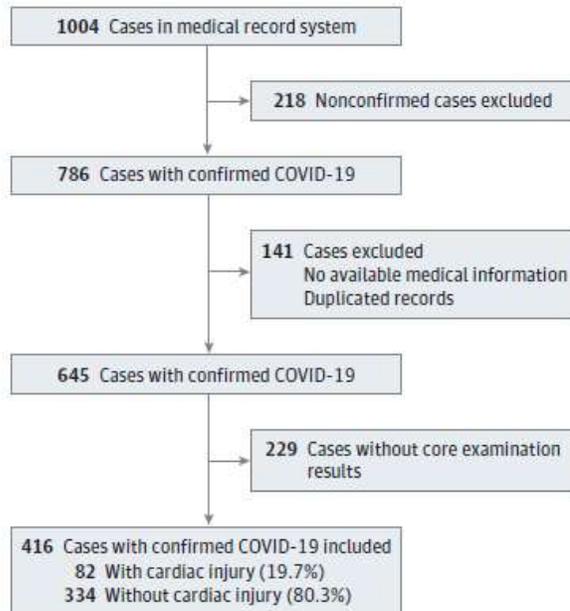
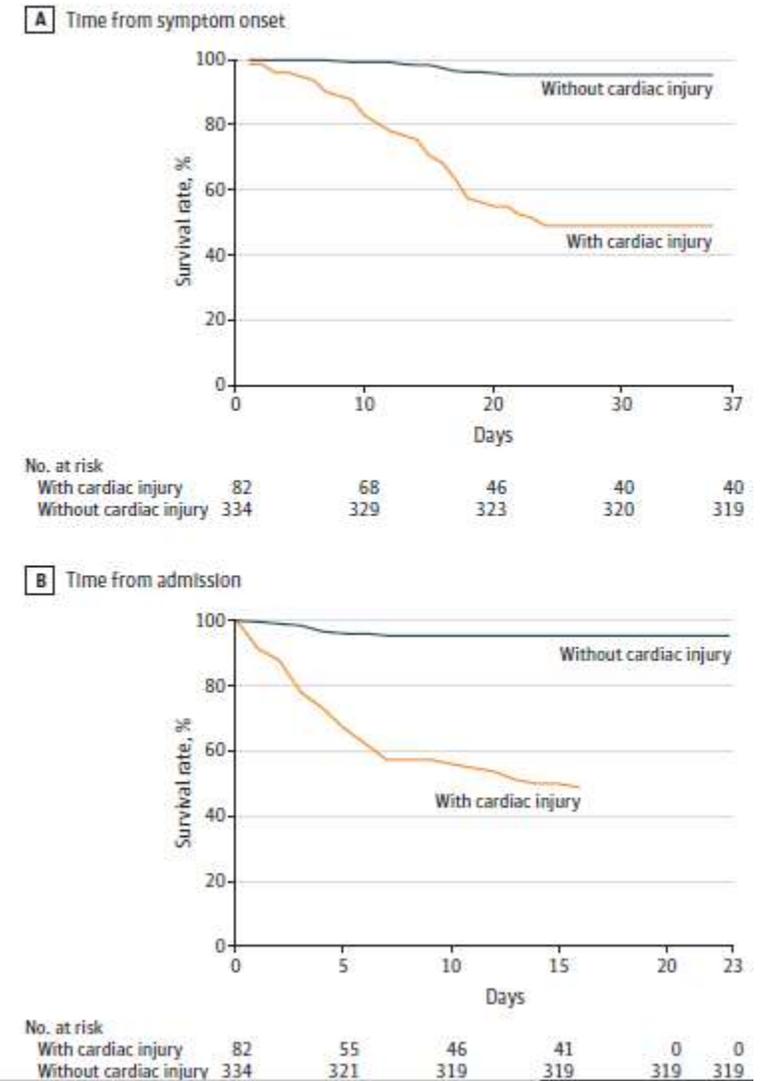


Figure 2. Mortality During Hospitalization Between Patients With vs Without Cardiac Injury





## Cardiovascular complications in coronavirus disease 2019.

Manifestation	Incidence	Remarks
<b>Acute cardiac injury*</b> (most commonly defined as elevation of cardiac troponin I above 99th percentile upper reference limit)	8–12% on average [10]	<ul style="list-style-type: none"> <li>• Most commonly reported cardiovascular abnormality</li> <li>• Can result from any of the following mechanisms-               <ul style="list-style-type: none"> <li>• Direct myocardial injury</li> <li>• Systemic inflammation</li> <li>• Myocardial oxygen demand supply mismatch</li> <li>• Acute coronary event</li> <li>• Iatrogenic</li> </ul> </li> </ul>
<b>Acute coronary event</b>	Not reported, but appears to be low	<ul style="list-style-type: none"> <li>• Strong adverse prognostic value</li> </ul> Potential mechanisms- <ul style="list-style-type: none"> <li>• Plaque rupture due to inflammation/increased shear stress</li> <li>• Aggravation of pre-existing coronary artery disease</li> </ul>
<b>Left ventricular systolic dysfunction</b>	Not reported	Any of the causes of myocardial dysfunction mentioned above can lead to acute left ventricular systolic dysfunction
<b>Heart failure</b>	Reported in one study- 52% in those who died, 12% in those who recovered and were discharged [5]	<ul style="list-style-type: none"> <li>• Any of the causes of myocardial dysfunction mentioned above can lead to acute heart failure</li> <li>• Increased metabolic demand of a systemic disease can cause acute decompensation of pre-existing stable heart failure</li> </ul>
<b>Arrhythmia</b>	16.7% overall; 44.4 in severe illness, 8.9% in mild cases [8]	Both tachyarrhythmia and bradyarrhythmia can occur but exact nature not described
<b>Potential long-term consequences</b>	Too early to assess	Too early to ascertain for coronavirus disease 2019. However, patients recovering from a similar earlier illness- Severe Acute Respiratory Syndrome- continued to have long-term abnormalities of lipid and glucose metabolism and of cardiovascular homeostasis [12]

\* Acute cardiac injury is a non-specific term with significant overlap with other cardiovascular manifestations; however, it is listed here because of how reporting has been done in most of the studies on coronavirus disease 2019.

THE PRESENT AND FUTURE

JACC STATE-OF-THE-ART REVIEW

## Cardiovascular Considerations for Patients, Health Care Workers, and Health Systems During the COVID-19 Pandemic



Elissa Driggin, MD,<sup>1,2\*</sup> Mahesh V. Madhavan, MD,<sup>3,4\*</sup> Behnood Bickdeli, MD, MS,<sup>5,6\*</sup> Taylor Chuich, PharmD,<sup>7</sup> Justin Laracy, MD,<sup>8</sup> Giuseppe Biondi-Zoccai, MD, MSTAT,<sup>9,10</sup> Tyler S. Brown, MD,<sup>11</sup> Caroline Der Nigoghossian, PharmD,<sup>2</sup> David A. Zidar, MD, PhD,<sup>2</sup> Jennifer Haythe, MD,<sup>2</sup> Daniel Brodie, MD,<sup>2</sup> Joshua A. Beckman, MD,<sup>2</sup> Ajay J. Kirtane, MD, SM,<sup>4,12</sup> Gregg W. Stone, MD,<sup>13</sup> Harlan M. Krumholz, MD SM,<sup>14,15</sup> Sahil A. Parikh, MD<sup>4,16</sup>

### RISK FACTORS



PRIOR CVD



IMMUNE ACTIVATION



SHOCK



METABOLIC DISARRAY



COAGULOPATHY



IMMOBILITY



### CARDIOVASCULAR COMPLICATIONS

ARRHYTHMIA

MYOCARDITIS

ACUTE CORONARY SYNDROME

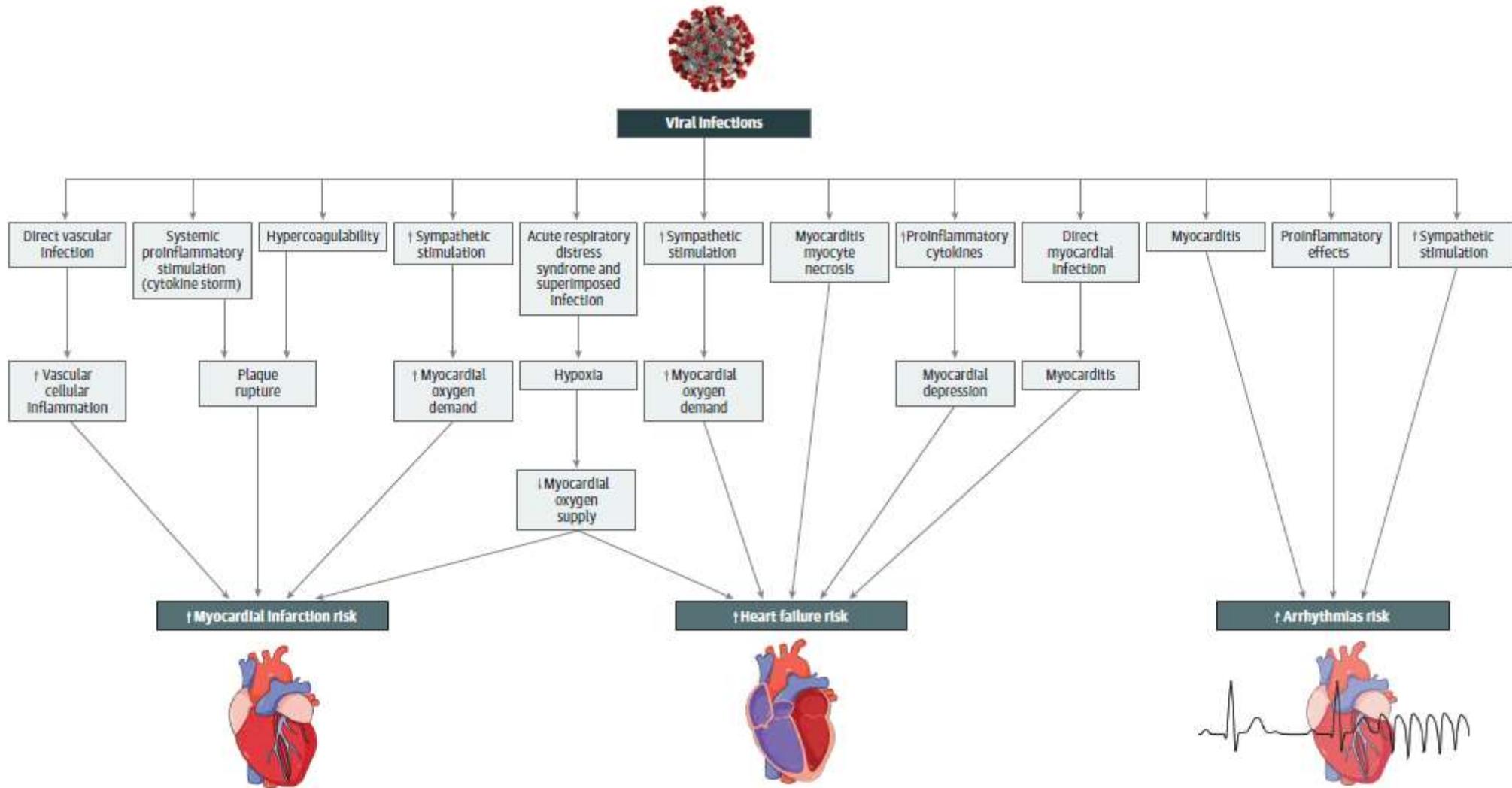
VENOUS THROMBOEMBOLISM

CARDIOGENIC SHOCK

HEART FAILURE

Risk factors for complications in patients afflicted with coronavirus disease 2019 (COVID-19) and potential cardiovascular issues that may result from this disease process. CVD = cardiovascular disease.

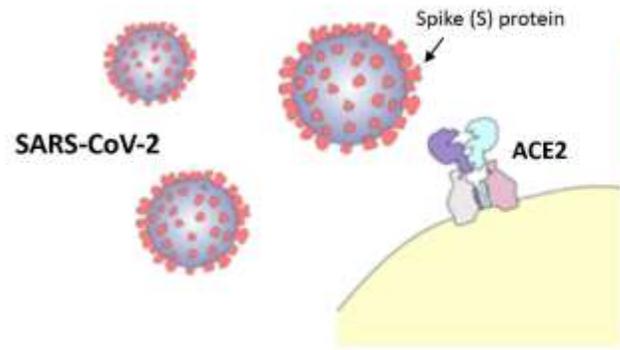
Figure. Potential Mechanisms for Acute Effects of Viral Infections on Cardiovascular System



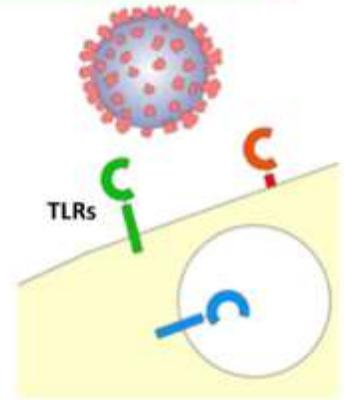
JAMA Cardiology | Review

## Potential Effects of Coronaviruses on the Cardiovascular System A Review

Mohammad Madjid, MD, MS; Payam Safavi-Naeini, MD; Scott D. Solomon, MD; Orly Vardeny, PharmD

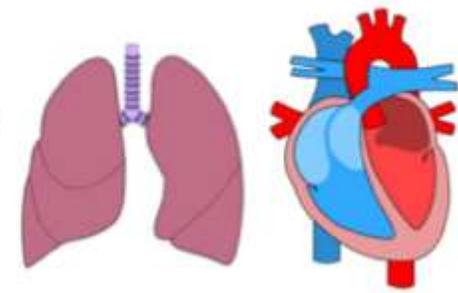


SARS-CoV2 entry is mediated by binding of the viral spike (S) protein to the membrane-bound ACE2, which is highly expressed in the lungs and cardiovascular system.

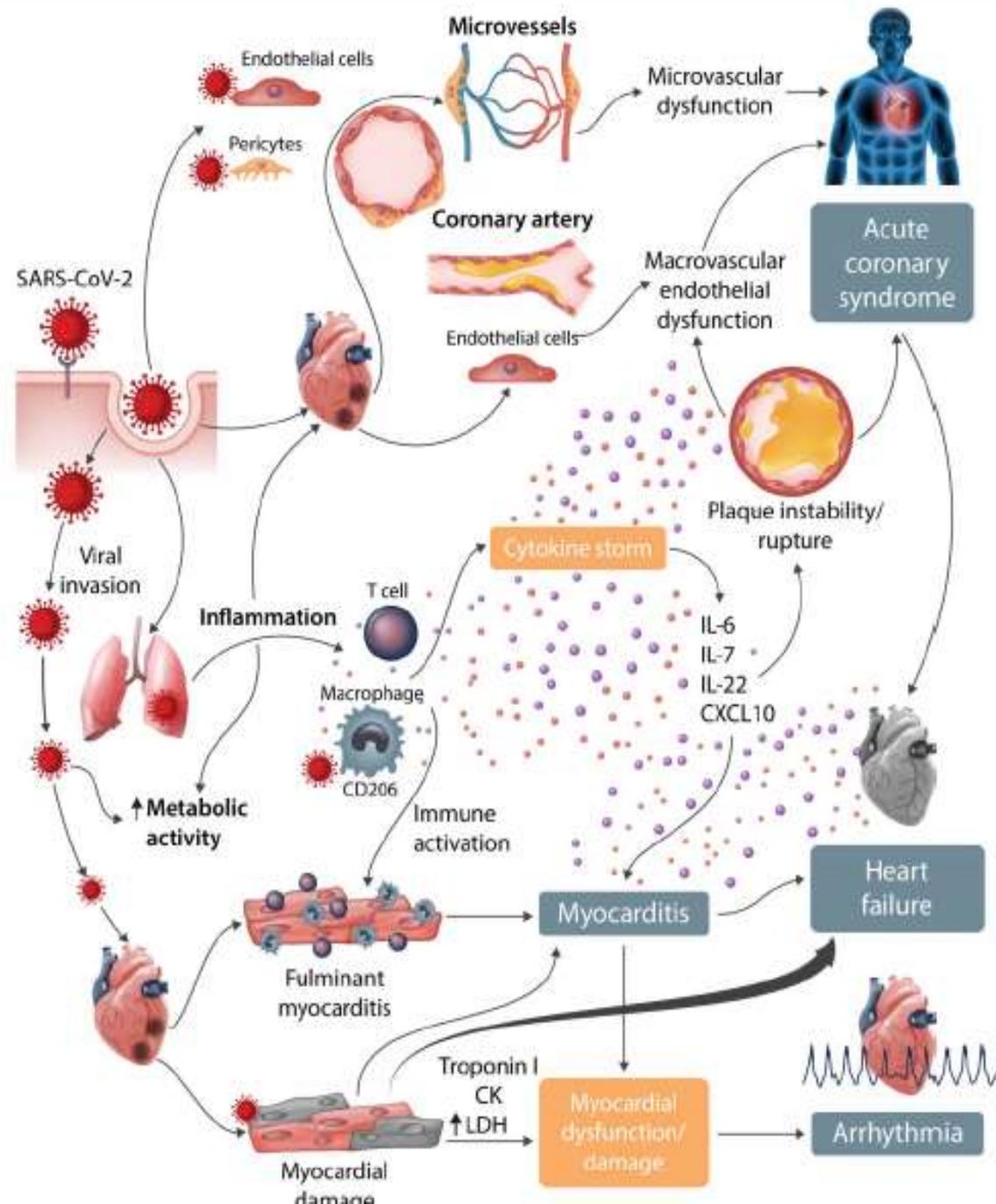


Viral proteins and genomes are recognized by TLR family receptors on cell surface and endosomal compartment; this leads to cytokine synthesis and release (IL-6, IFN- $\gamma$ , and TNF- $\alpha$ ), as well as inflammasome activation.

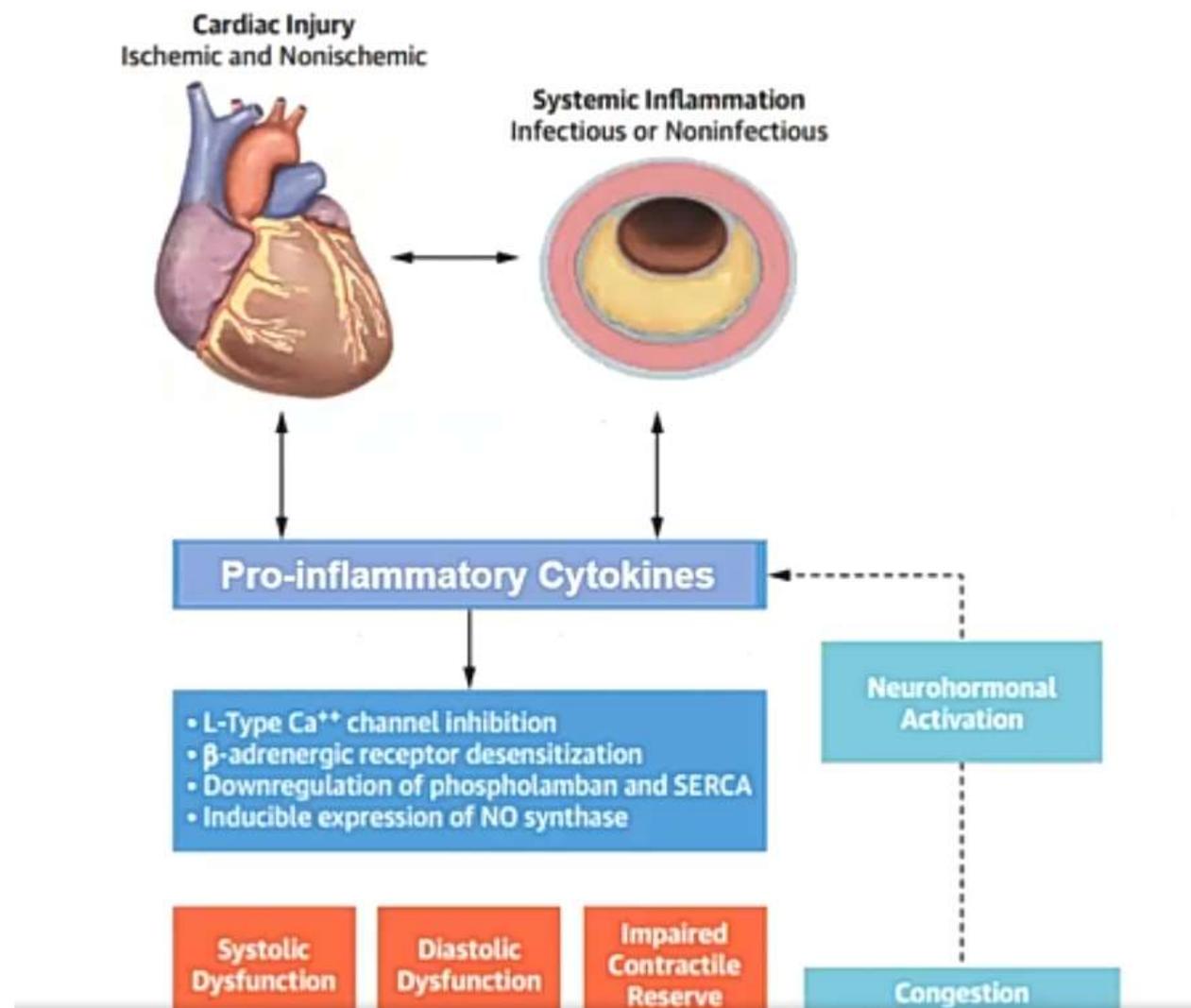
Inflammasome activation leads to enhanced release of pro-inflammatory IL-1 $\beta$ , fostering further cytokine secretion, potentially leading to a "cytokine storm".



Excess uncontrolled inflammation may ultimately cause end-organ damage, particularly in the respiratory and cardiovascular systems.



# Systemic Inflammation and Cardiac Dysfunction

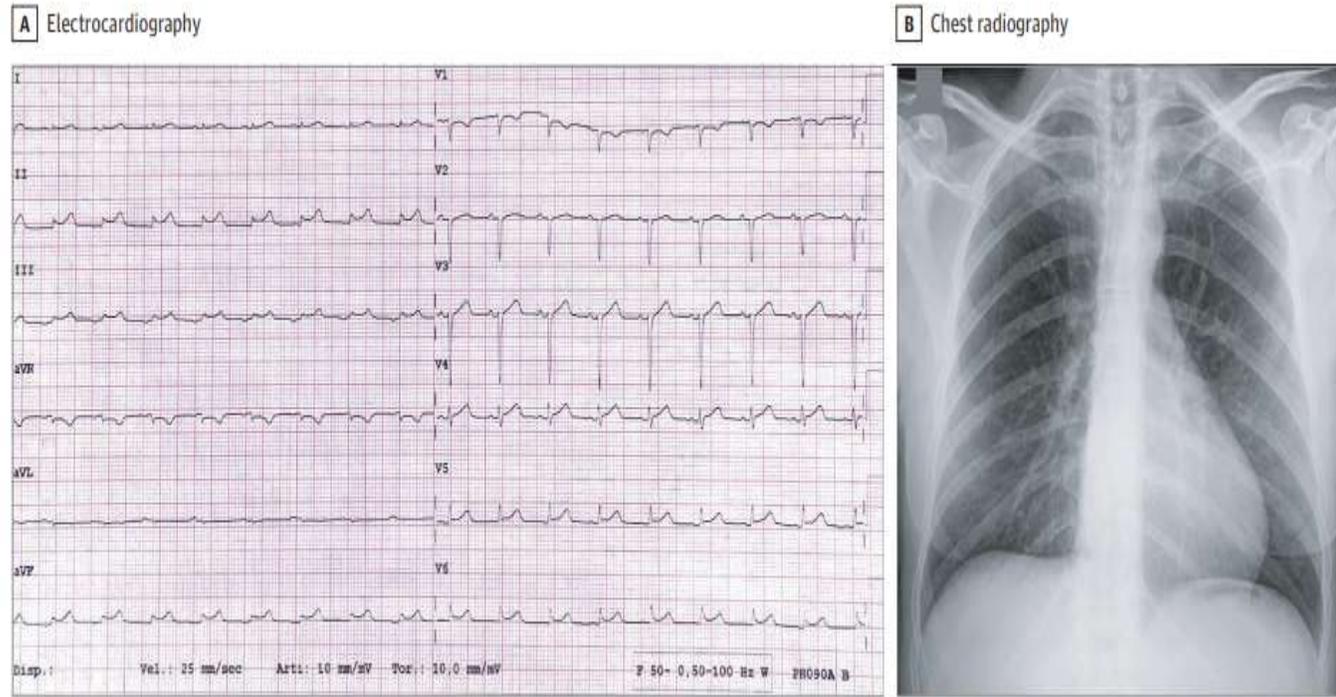


# Cardiac Involvement in a Patient With Coronavirus Disease 2019 (COVID-19)

Riccardo M. Inciardi, MD; Laura Lupi, MD; Gregorio Zaccone, MD; Leonardo Italia, MD; Michela Raffo, MD; Daniela Tomasoni, MD; Dario S. Cani, MD; Manuel Cerini, MD; Davide Farina, MD; Emanuele Gavazzi, MD; Roberto Maroldi, MD; Marianna Adamo, MD; Enrico Ammirati, MD, PhD; Gianfranco Sinagra, MD; Carlo M. Lombardi, MD; Marco Metra, MD

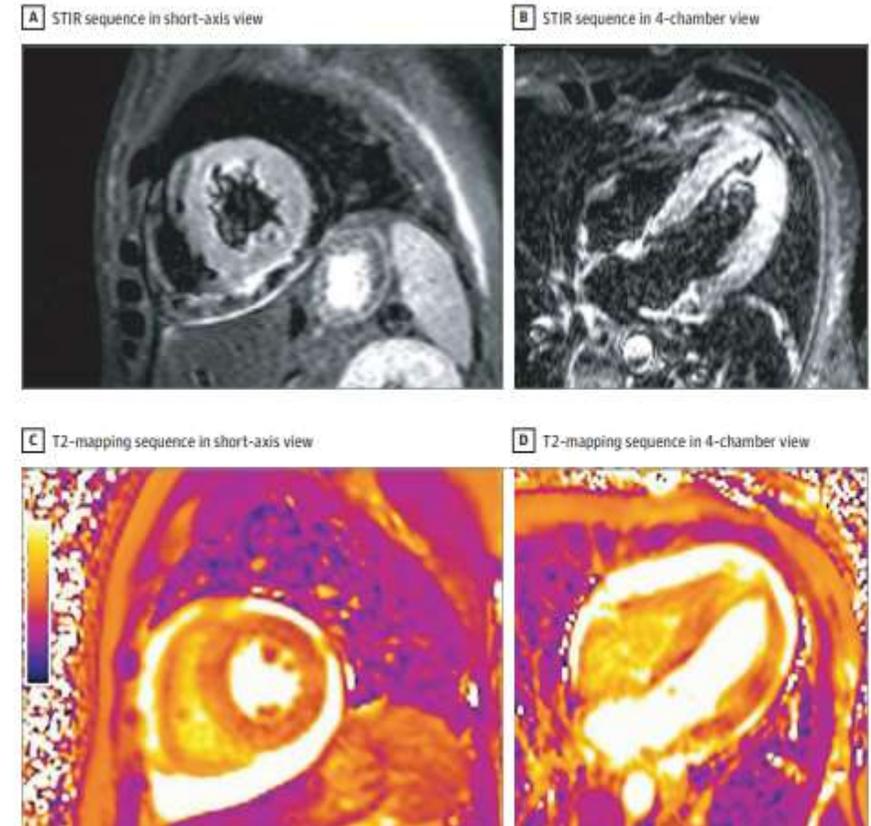
Femenina de 52 años, sin antecedente de ECV, disnea hace dos días, fiebre tos una semana atrás, ECO: FEVI:40% hipocinesia difusa, derrame pericárdico sin signos de taponamiento.

Figure 1. Electrocardiographic and Chest Radiographic Findings



A, Electrocardiography showing sinus rhythm with low voltage in the limb leads, diffuse ST-segment elevation (especially in the inferior and lateral leads), and ST-segment depression with T-wave inversion in leads V1 and aVR. B,

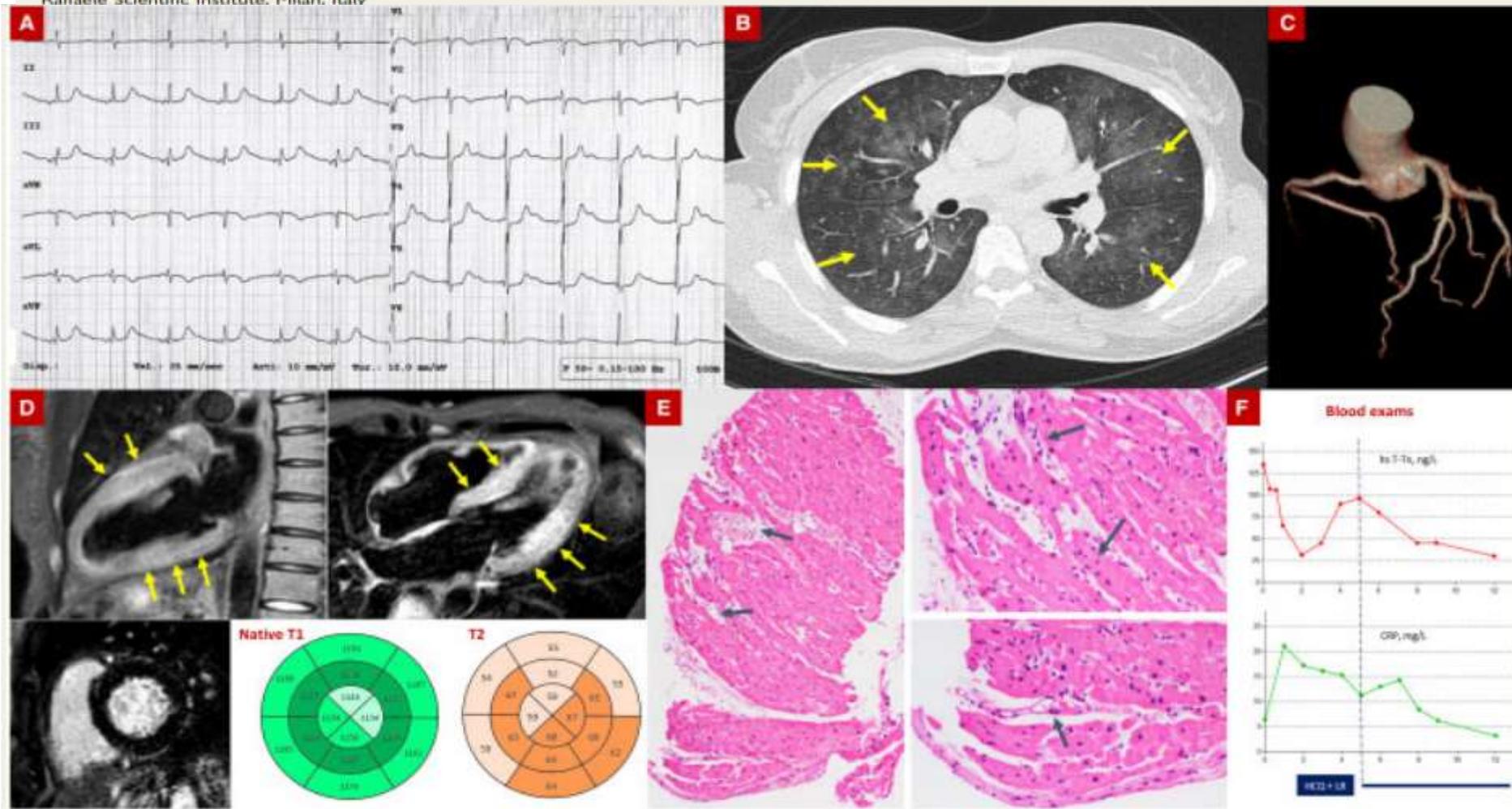
Posteroanterior chest radiography at presentation. No thoracic abnormalities were noted.



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

Simone Sala <sup>1</sup>, Giovanni Peretto <sup>1,2,†</sup>, Mario Gramegna <sup>3</sup>, Anna Palmisano <sup>2,4</sup>, Andrea Villatore <sup>2</sup>, Davide Vignale <sup>4</sup>, Francesco De Cobelli <sup>2,4</sup>, Moreno Tresoldi <sup>5</sup>, Alberto Maria Cappelletti <sup>3</sup>, Cristina Basso <sup>6</sup>, Cosmo Godino <sup>7,†</sup>, and Antonio Esposito <sup>2,4,†</sup>

<sup>1</sup>Department of Cardiac Electrophysiology and Arrhythmology, Myocarditis Unit, IRCCS San Raffaele Scientific Institute, Milan, Italy; <sup>2</sup>School of Medicine, Vita-Salute San Raffaele University, Milan, Italy; <sup>3</sup>Department of Cardiac Intensive Care Unit, IRCCS San Raffaele Scientific Institute, Milan, Italy; <sup>4</sup>Experimental Imaging Center, Radiology Unit, IRCCS San Raffaele Scientific Institute, Milan, Italy; <sup>5</sup>Unit of General Medicine and Advanced Care, IRCCS San Raffaele Scientific Institute, Milan, Italy; <sup>6</sup>Department of Cardiac Thoracic Vascular Sciences and Public Health, Cardiovascular Pathology, Padua University, Padua, Italy; and <sup>7</sup>Department of Clinical Cardiology, IRCCS San Raffaele Scientific Institute, Milan, Italy



## CLINICAL CASE

# Takotsubo Syndrome in the Setting of COVID-19

Anum S. Minhas, MD,<sup>a,b</sup> Paul Scheel, MD,<sup>a</sup> Brian Garibaldi, MD,<sup>c</sup> Gigi Liu, MD, MS,<sup>d</sup> Maureen Horton, MD,<sup>c</sup> Mark Jennings, MD, MHS,<sup>c</sup> Steven R. Jones, MD,<sup>a</sup> Erin D. Michos, MD, MHS,<sup>a,b</sup> Allison G. Hays, MD<sup>a</sup>

## ABSTRACT

A 58-year-old woman was admitted with symptoms of coronavirus disease 2019. She subsequently developed mixed shock, and an echocardiogram showed mid-distal left ventricular hypokinesis and apical ballooning, findings typical of stress, or takotsubo, cardiomyopathy. Over the next few days her left ventricular function improved, the further supporting the reversibility of acute stress cardiomyopathy. (Level of Difficulty: Beginner.) (J Am Coll Cardiol Case Rep 2020;■:■-■) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

FIGURE 2 Strain Imaging on Initial Echocardiogram

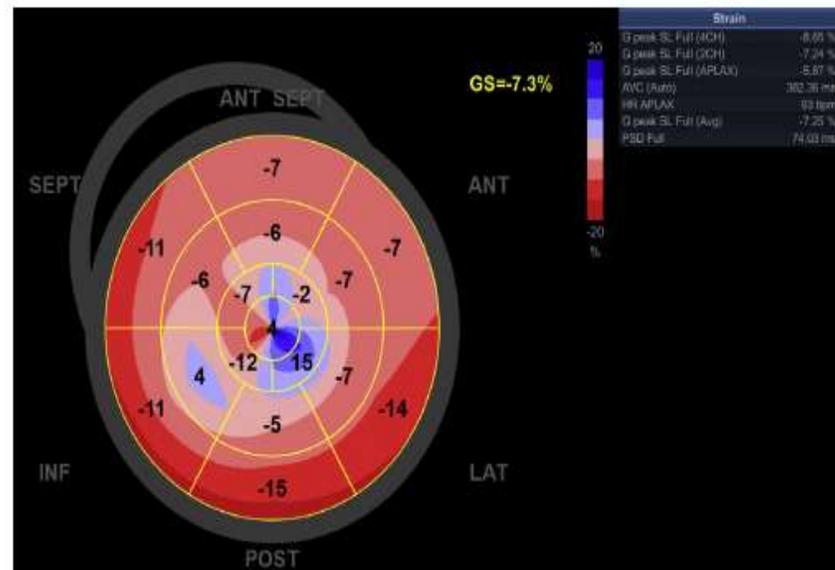
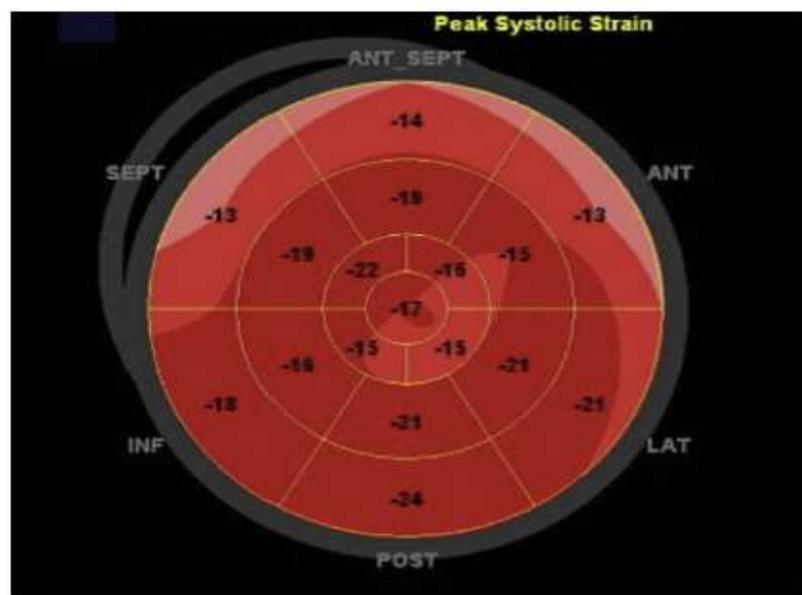
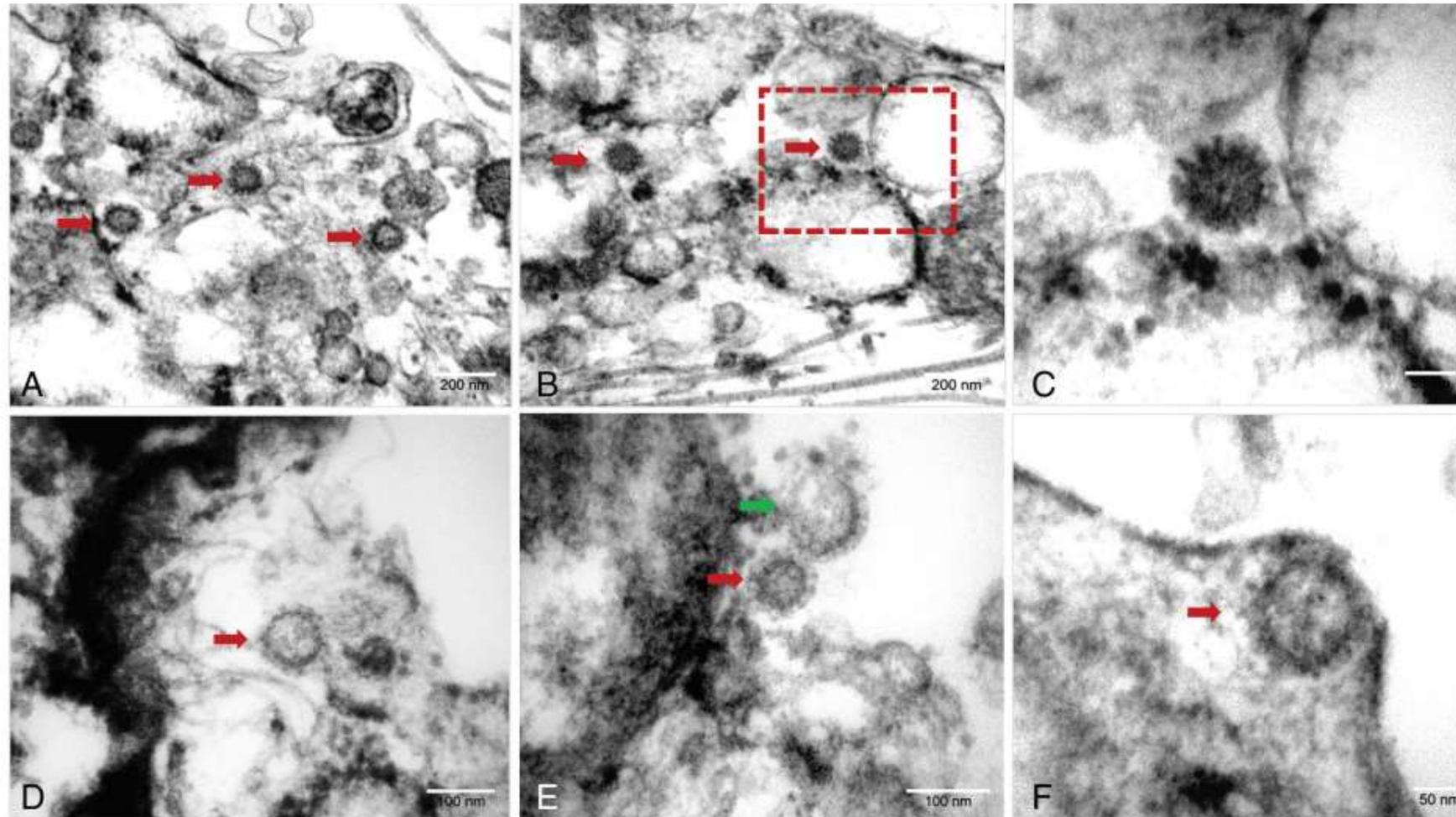


FIGURE 3 Strain Imaging on Repeat Echocardiogram

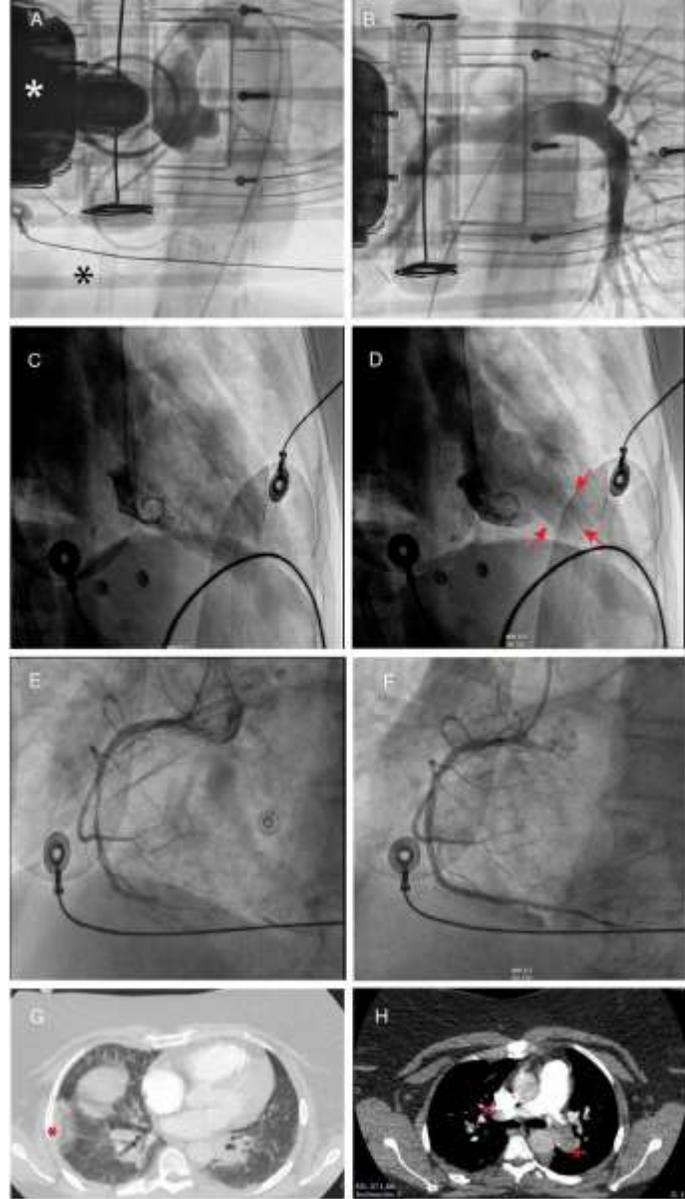


## Myocardial localization of coronavirus in COVID-19 cardiogenic shock



Características clínicas, analíticas y de imagen, tratamientos y evolución de los 4 pacientes complicados con *shock* cardiogénico

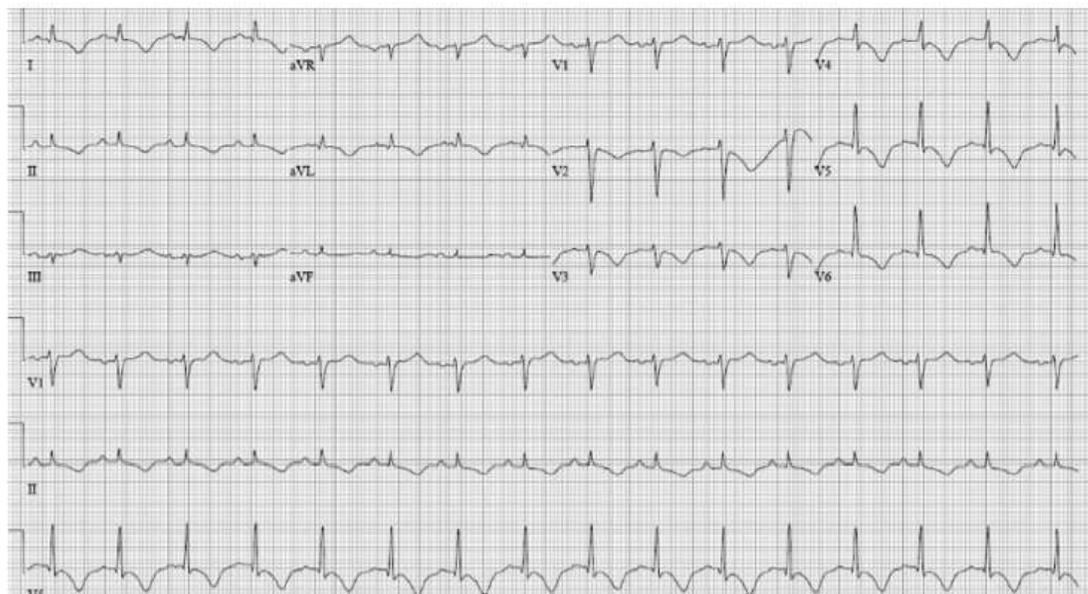
	Caso 1	Caso 2	Caso 3	Caso 4
Sexo	Mujer	Varón	Varón	Mujer
Edad (años)	42	50	75	37
Inicio de síntomas-ingreso en urgencias (días)	12	8	2	10
Clinica	Disnea, diarrea, vómitos, anosmia y disgeusia	Fiebre, disnea y tos	Disnea	Fiebre, disnea y dolor torácico
ECG	Ritmo sinusal con BRIHH de reciente aparición	Taquicardia sinusal con elevación del segmento ST de 2 mm lateral	Bloqueo auriculoventricular completo con elevación del segmento ST inferior	Taquicardia sinusal Patrón SIQHITIII Dudosa elevación del segmento ST anterior
Radiografía de tórax	Cardiomegalia. Infiltrados bilaterales difusos	Extensa afección pulmonar bilateral por tenues opacidades parcheadas en pulmón derecho y tenue aumento de densidad difuso del pulmón izquierdo, de predominio en campos medios Ausencia de cardiomegalia	Opacidades parenquimatosas bilaterales Ausencia de cardiomegalia	Aumento de densidad periférica en la base derecha que borra el seno costofrénico compatible con consolidación pulmonar periférica
Ecocardiograma	VI dilatado con FEVI gravemente reducida e hipocinesia global Sin derrame pericárdico	VI no dilatado con acinesia de todos los segmentos basales e hipercontractilidad de los segmentos medio-apicales. Cavidades derechas normales No derrame pericárdico	VI no dilatado con acinesia inferior basal con disfunción moderada VD muy dilatado con disfunción grave Sin derrame pericárdico	No realizado
Cateterismo	Arterias coronarias normales Arterias pulmonares normales	Arterias coronarias normales Ventriculografía con patrón de <i>tako-tsubo</i> invertido	Oclusión trombótica del segmento medio de la coronaria derecha	Sin tiempo para realizarlo
Troponina I (ng/ml)	70,4 (VN < 0,1)	64,1	500	0,4
Posible diagnóstico cardiológico	Miocarditis fulminante	Miocardiopatía de estrés <i>Tako-tsubo</i> invertido	Infarto inferior Killip III	TEP bilateral de alto riesgo
Evolución clínica	Parada cardiorrespiratoria Maniobras de RCP Tormenta arritmica FV refractaria <i>Shock</i> cardiogénico ECMO-VA y BCIA Ventilación mecánica Fallecimiento	<i>Shock</i> mixto (cardiogénico inicial y séptico después) Ventilación mecánica Asistencia vasoactiva (3 días) Alta domiciliaria a los 11 días Normalización de las alteraciones en la contractilidad	Parada cardiorrespiratoria FV primaria ICP primaria <i>Shock</i> cardiogénico refractario a amins vasoactivas Ventilación mecánica Fracaso multiorgánico Fallecimiento	<i>Shock</i> cardiogénico Parada cardiorrespiratoria y disociación electromecánica Fallecimiento tras maniobras de RCP



Caso 1 (A-B) Aortografía en paciente con ECMO, aorta y coronarias normales  
 Caso 2 (C-D) Ventriculografía , Takotsubo reverso  
 Caso 3 (E-F) Coronariografía , oclusión CD segmento medio, colocación de Stent  
 Caso 4 (G-H) Angiotomografía de arterias pulmonares, TEP



**FIGURE 3** Electrocardiogram After Pericardiocentesis



JACC: CASE REPORTS

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VOL. ■, NO. ■, 2020

## CASE REPORT

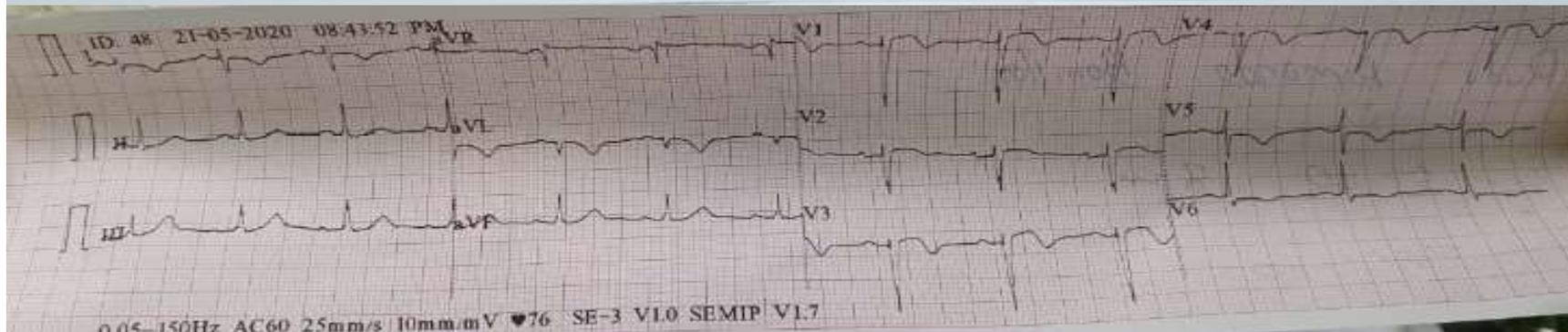
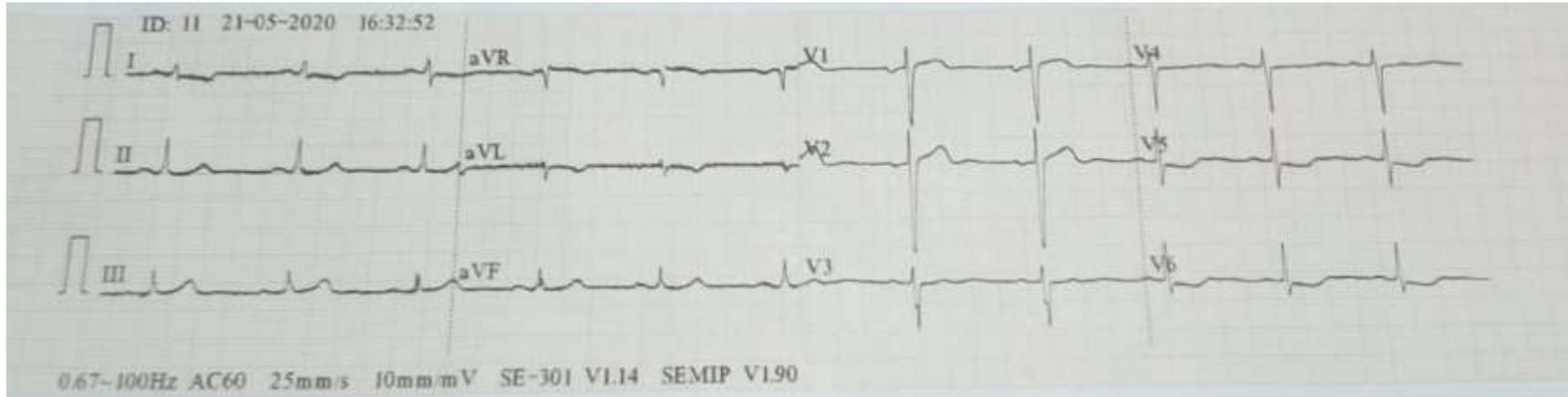
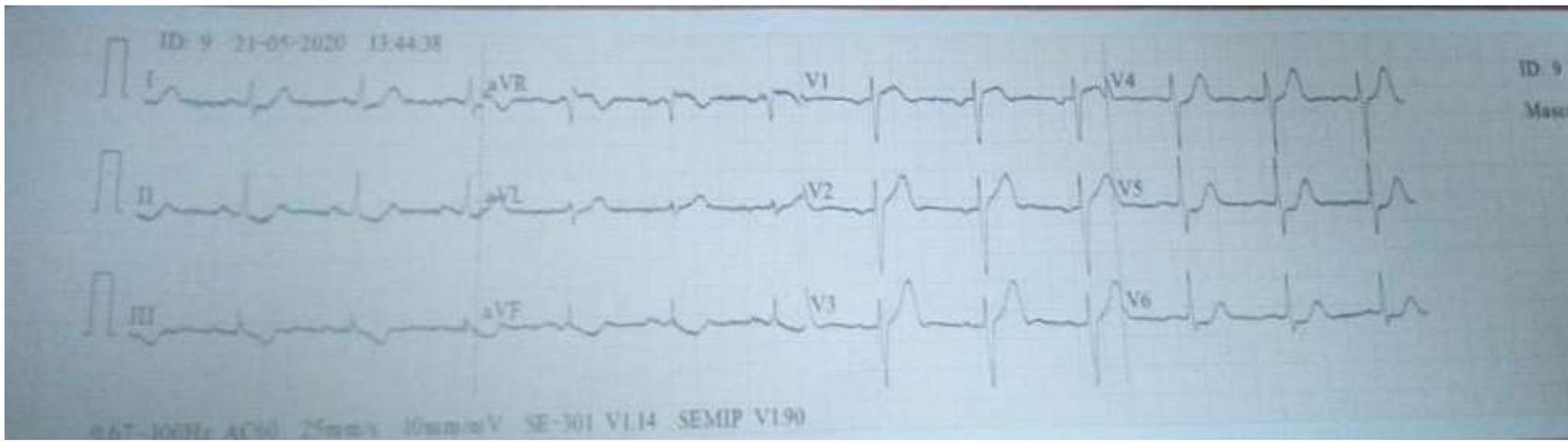
### CLINICAL CASE

# Cardiac Tamponade Secondary to COVID-19

Mohammed F. Dabbagh, MD,<sup>a</sup> Lindsey Aurora, MD,<sup>a</sup> Penny D'Souza, DO,<sup>a</sup> Allison J. Weinmann, MBBS,<sup>b</sup> Pallavi Bhargava, MD,<sup>b</sup> Mir B. Basir, DO<sup>a</sup>

INTERMEDIATE





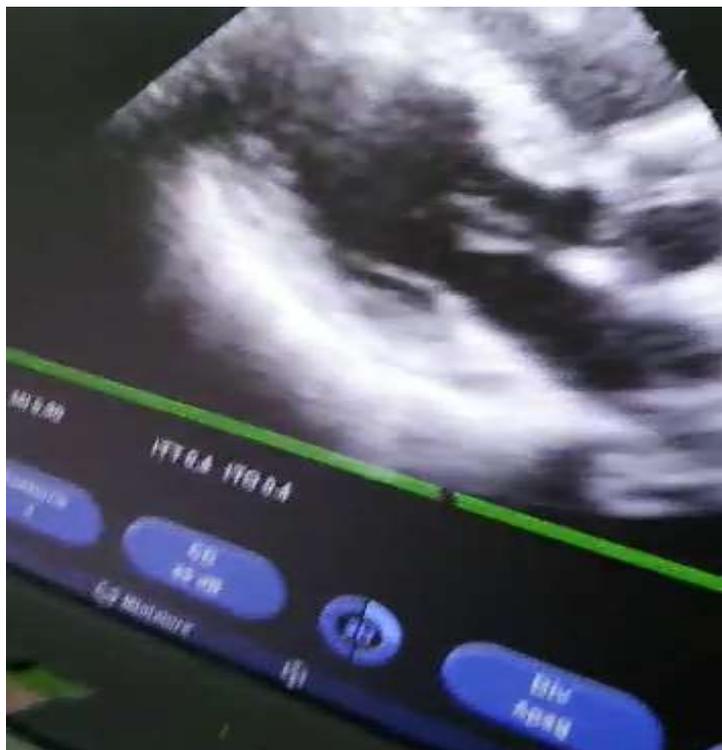
Masculino de 48 años, HTA estadio I no tratada, obesidad central, estrés, 14 días de prueba covid +  
No síntomas respiratorios, cefalea una semana previa al evento de dolor precordial



■

Química e Inmunología

PRUEBA	RESULTADO	UNIDAD	RANGOS REFERENCIA
Tropinina T (Hs STAT)	* 4.14	ng/mL.	0.0 - 0.0249 ng/mL.





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## Troponin and BNP Use in COVID-19

Mar 18, 2020

- Clinicians are advised to only measure troponin if the diagnosis of acute MI is being considered on clinical grounds and an abnormal troponin should not be considered evidence for an acute MI without corroborating evidence
- Use of echocardiography or coronary angiography for COVID-19 patients with myocardial injury or elevated natriuretic peptide should be restricted to those patients in whom these procedures would be expected to meaningfully affect outcome.

Journal of the American College of Cardiology  
March 2020  
DOI: 10.1016/j.jacc.2020.03.021

**CARDIOVASCULAR MEDICINE AND SOCIETY**

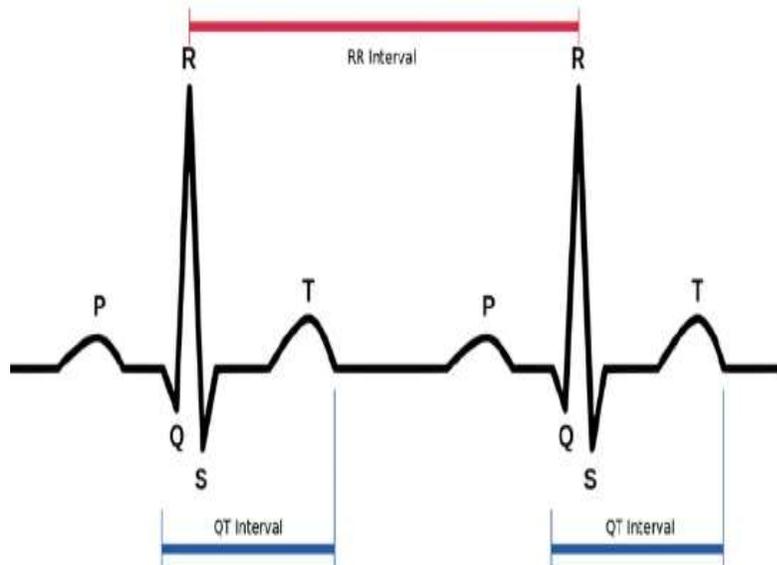
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Just Accepted

**Catheterization Laboratory Considerations During the Coronavirus (COVID-19) Pandemic: From ACC's Interventional Council and SCAI**

Frederick G.P. Welt, Pinak B. Shah, Herbert D. Aronow, Anna E. Bortnick, Timothy D. Henry, Matthew W. Sherwood, Michael N. Young, Laura J. Davidson, Sabeeda Kadavath, Ehtisham Mahmud, Ajay J. Kirtane and American College of Cardiology's (ACC) Interventional Council and the Society of Cardiovascular Angiography and Intervention (SCAI)

- Fibrinolysis to be considered an option in “stable STEMI” patients with confirmed COVID-19
- If primary PCI for STEMI, personnel should wear appropriate PPE during the case
- In NSTEMI, efforts should be made in differentiating type 1 vs. type 2 MI and medical management should be considered appropriate except in unstable pts (secondary to the ACS)

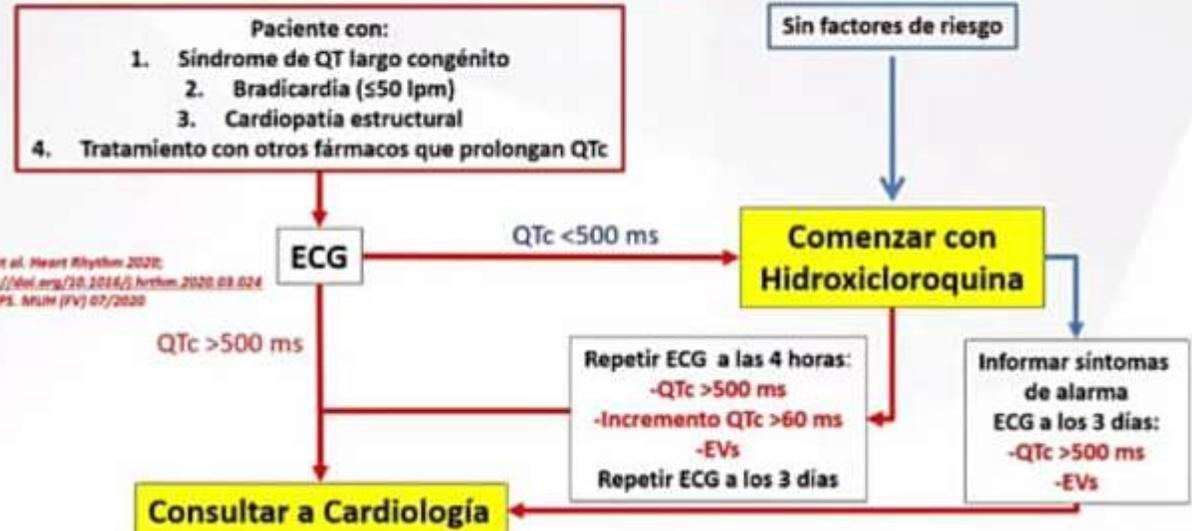


Intervalo QT e Intervalo RR.

$$QTc(Bazett) = \frac{QT}{\sqrt{RR}}$$

## Indicación de hidroxiclороquina

Evitar otros fármacos que prolongan el QTc

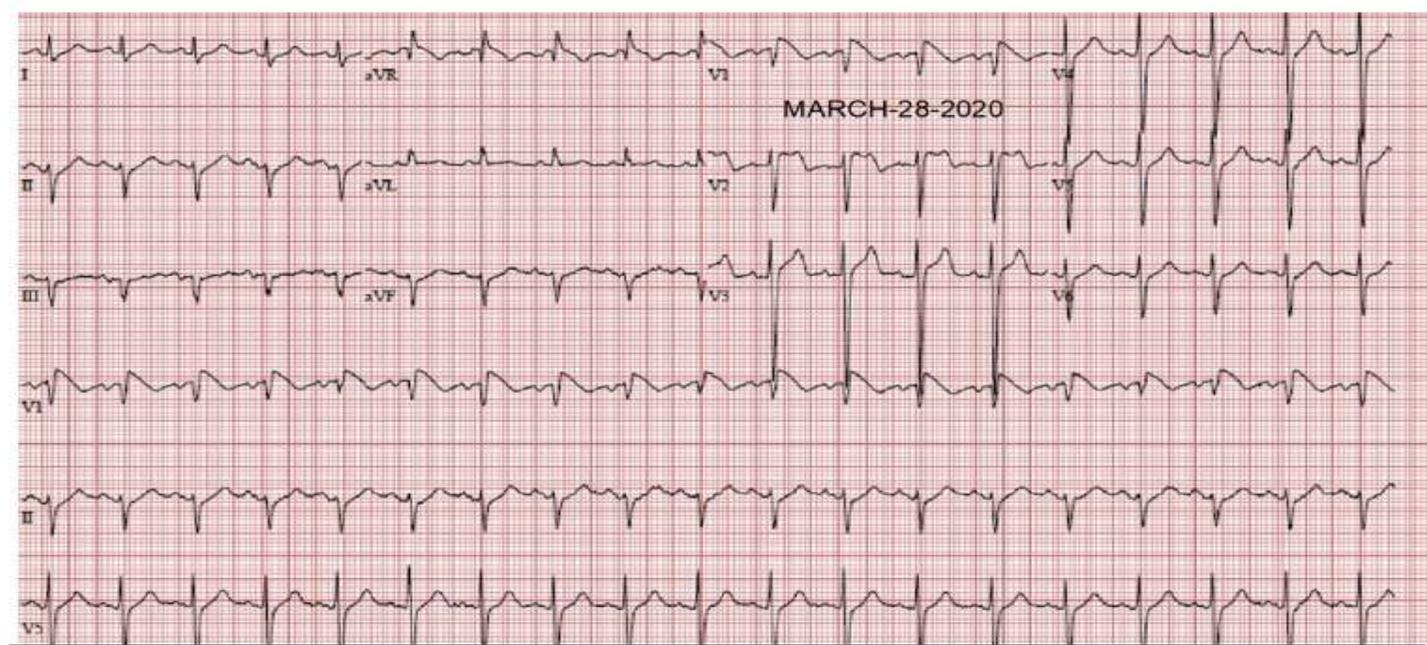


## IMAGING VIGNETTE

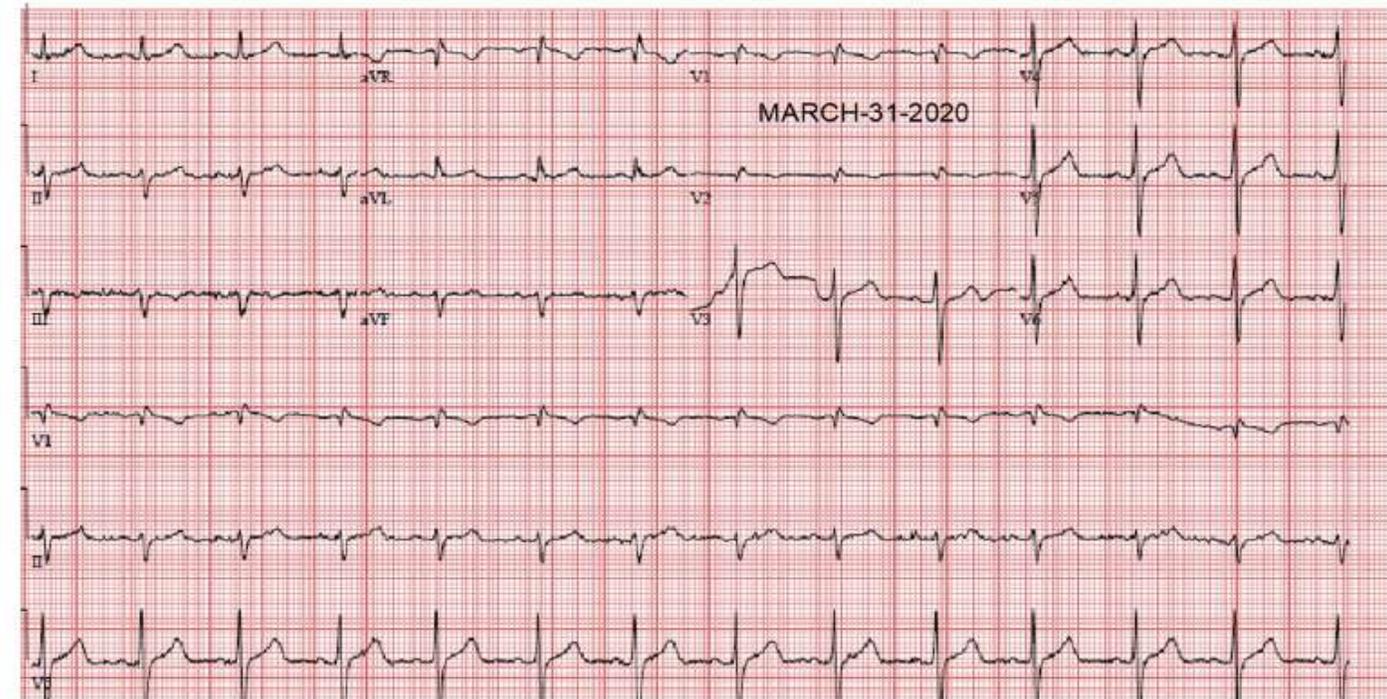
## CLINICAL VIGNETTE

# Transient Brugada-Like Electrocardiographic Pattern in a Patient With COVID-19

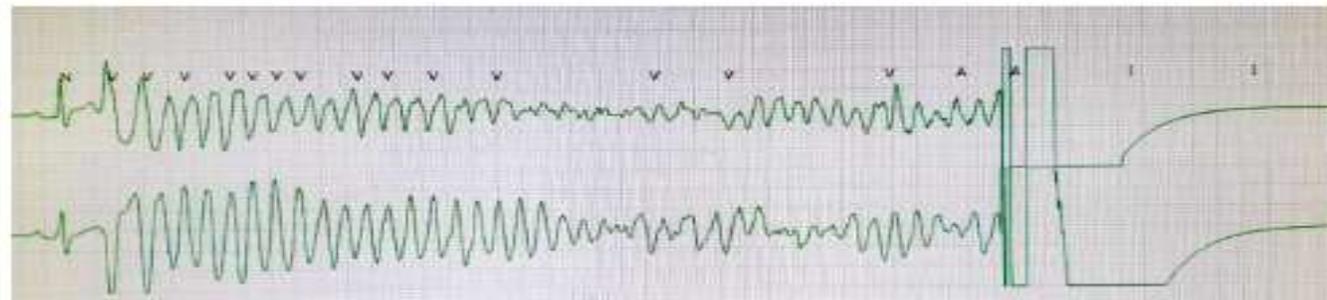
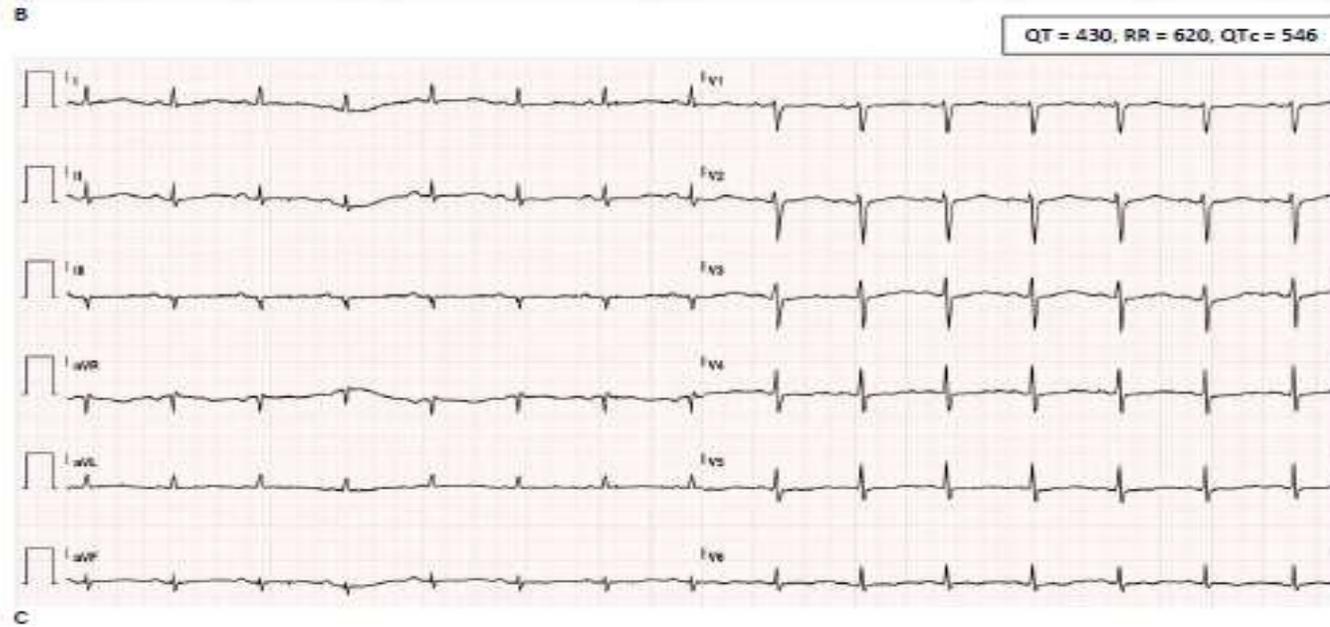
Mladen I. Vidovich, MD



**FIGURE 6** Electrocardiogram Demonstrating Resolution of Brugada-like Pattern in Right Precordial Leads



## QT Interval Prolongation and Torsade De Pointes in Patients with COVID-19 treated



## CASE REPORT

### CLINICAL CASE

# COVID-19 Complicated by Acute Pulmonary Embolism and Right-Sided Heart Failure

Waqas Ullah, MD,<sup>a</sup> Rehan Saeed, MD,<sup>a</sup> Usman Sarwar, MD,<sup>a</sup> Rajesh Patel, MD,<sup>a</sup> David L. Fischman, MD<sup>b</sup>

FIGURE 2 CT of the Chest and CT Pulmonary Angiography

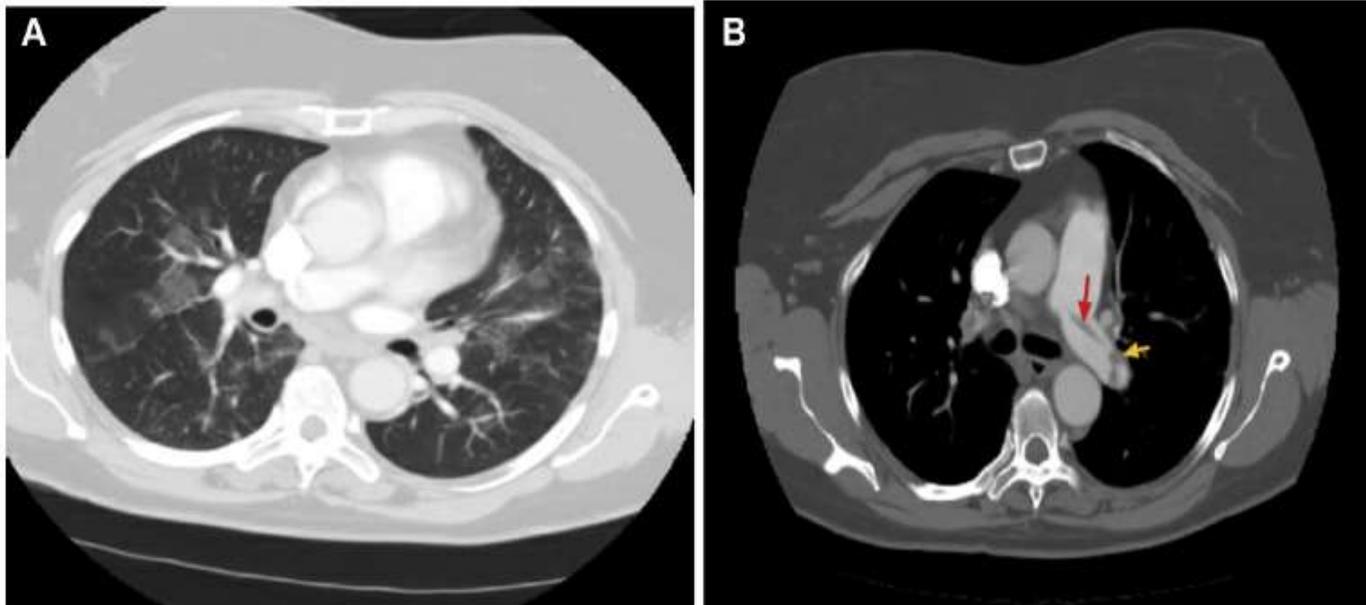
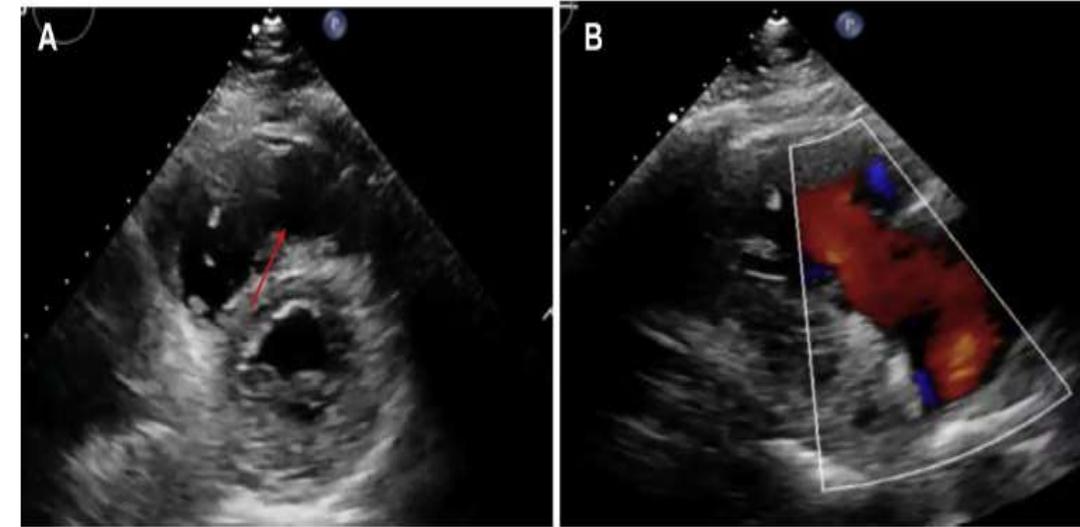


FIGURE 3 Bedside Transthoracic Echocardiography



(A) Parasternal short-axis view of the heart showing a dilated right ventricle (red arrow). (B) Doppler echocardiographic view of severe tricuspid regurgitation.





ESC

European Society  
of Cardiology

European Heart Journal - Cardiovascular Imaging (2020) 0, 1–7

doi:10.1093/ehjci/jeaa072

REVIEW

# COVID-19 pandemic and cardiac imaging: EACVI recommendations on precautions, indications, prioritization, and protection for patients and healthcare personnel

## Key point 3

Advice for cardiac imaging

- Echocardiography should not routinely be performed in patients with COVID-19 disease
- A range of different cardiovascular manifestations can be found in COVID-19 which may require cardiac imaging, including a bedside echocardiographic study
- A focused cardiac ultrasound study (FoCUS) is recommended to reduce the duration of exposure

# Escenarios clínicos Covid

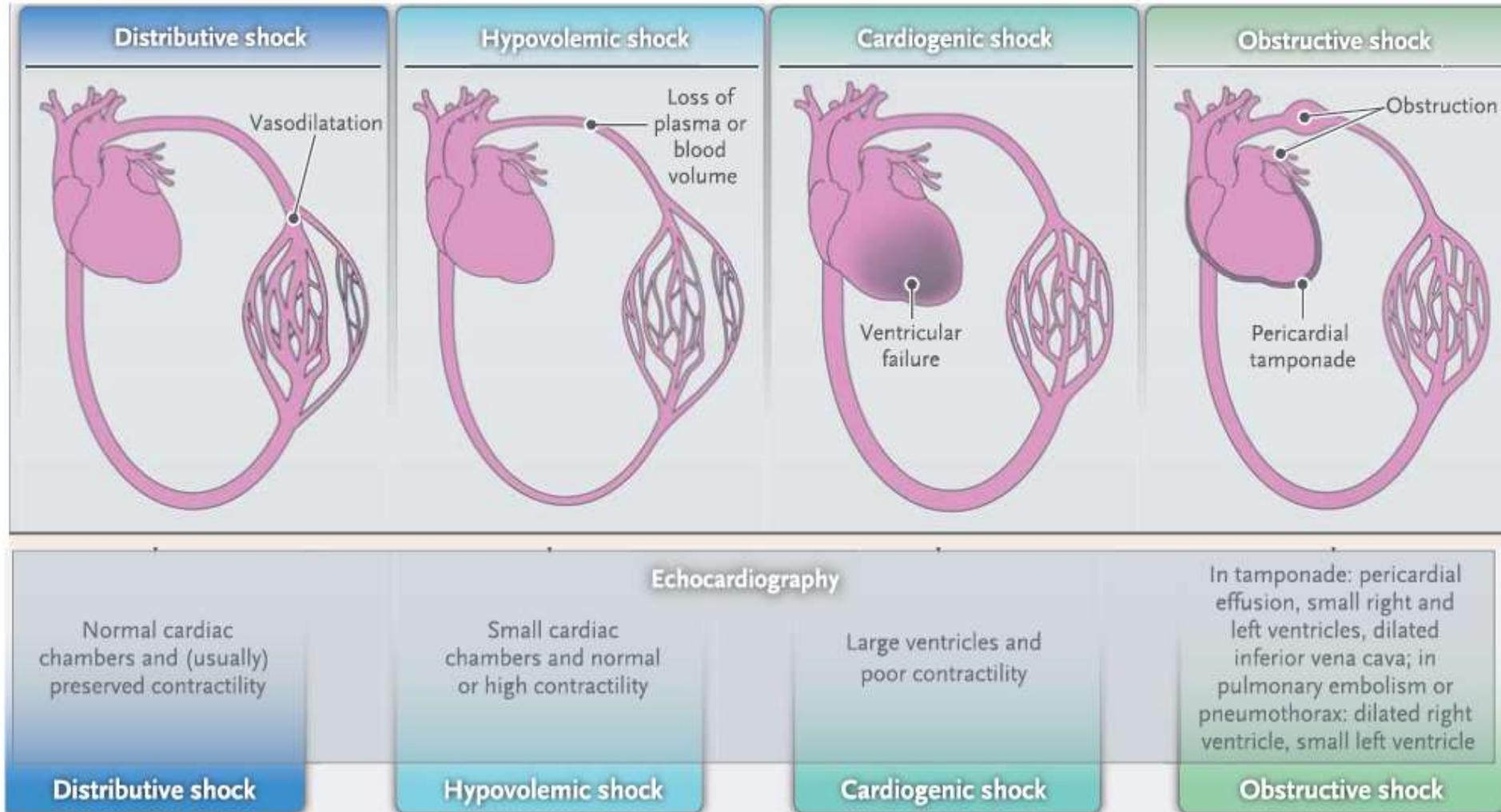
- Inestabilidad hemodinámica no justificada por COVID19 u otras comorbilidades
- Dolor torácico sugestivo de isquémica /alteraciones de EKG/Sospecha de Miocarditis.
- Derrame pericárdico > moderado en TAC
- Clínica de IC/ cardiomegalia no conocida sin cardiopatía previa.
- Alta sospecha de EI
- Sospecha de TEP

# Circulatory Shock



**EACVI**  
European Association of  
Cardiovascular Imaging

Jean-Louis Vincent, M.D., Ph.D., and Daniel De Backer, M.D., Ph.D.

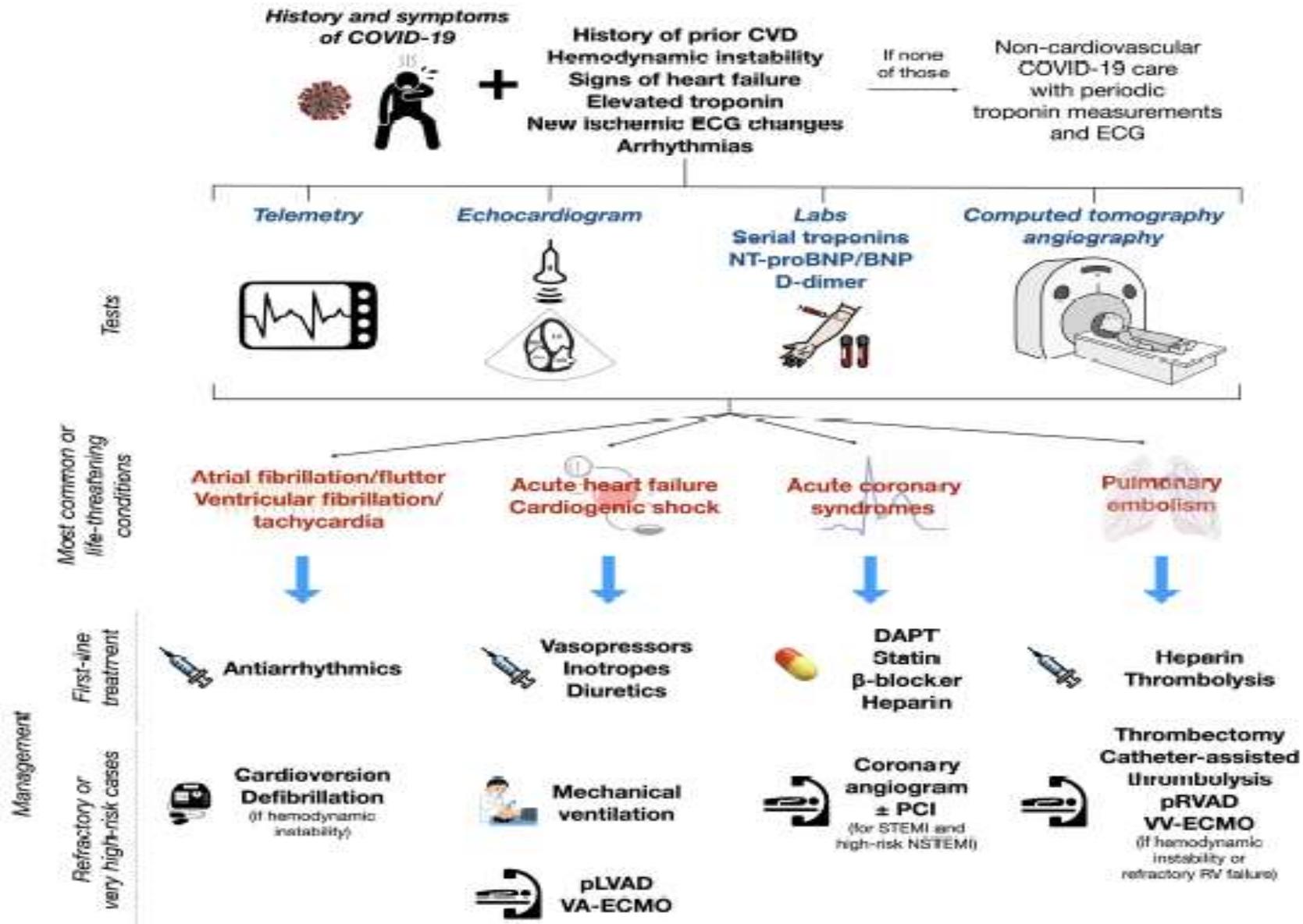




REVISIÓN Ecografía en el manejo del paciente crítico con infección por SARS-CoV-2 (COVID-19): aplicaciones clínicas en Medicina Intensiva-una revisión narrativa



# Cardiovascular implications of the COVID-19 pandemic: a global perspective





# Conclusiones

- Los antecedentes cardiovasculares son frecuentes en pacientes con Covid-19 lo que supone mayor morbimortalidad.
- Los pacientes con Covid-19 pueden presentar daño en el sistema cardiovascular que puede presentarse como miocarditis, takotsubo, SCA, arritmias, shock cardiongénico, falla de VD por TEP u otros mecanismos.
- La ecocardiografía permite evaluar de manera no invasiva la función cardíaca en pacientes con Covid-19 y sospecha de disfunción miocárdica.