

# UC Health Post-Acute Sequelae of SARS-CoV-2 Infection (PASC)/Long-COVID: Cardiology

Donald Grandis, M.D.

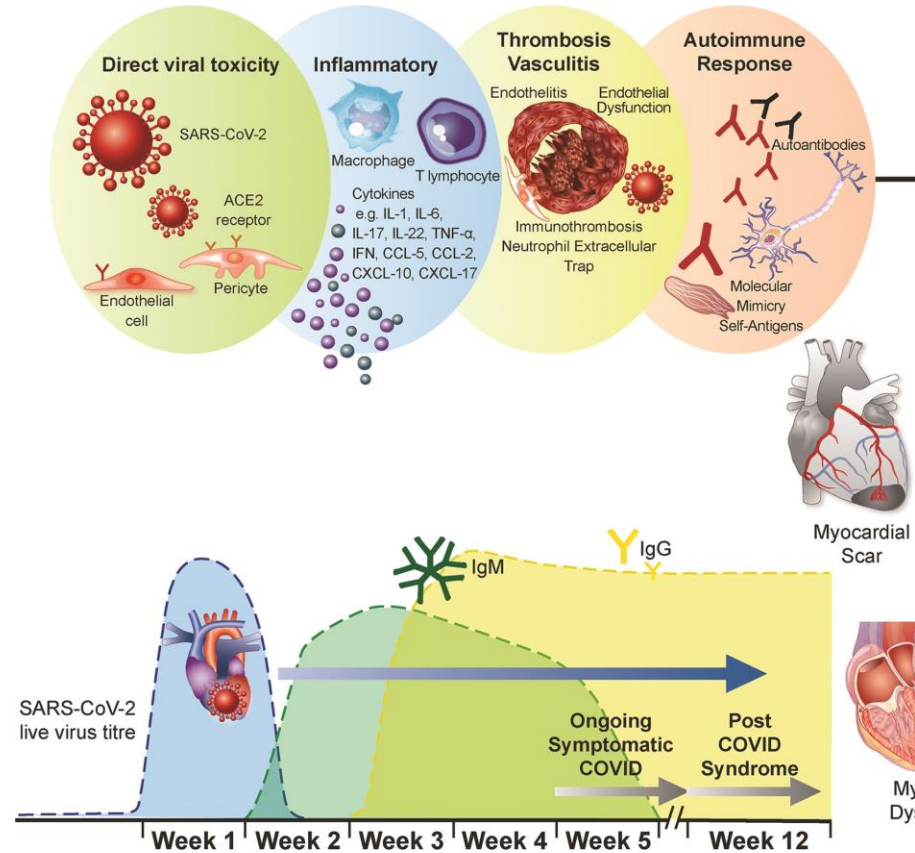
University of California San Francisco

# Disclosures

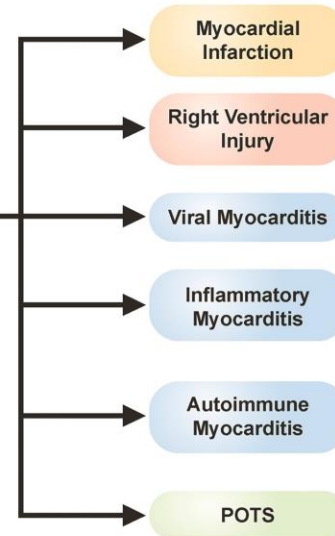
- None

# Pathophysiological mechanisms underlying acute and chronic severe acute Covid-19

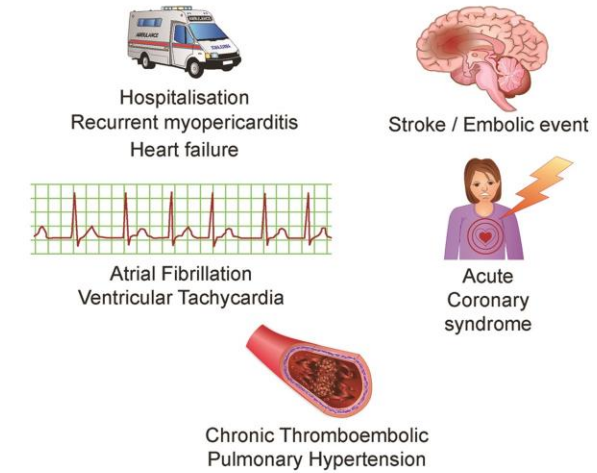
## A COVID-19 associated myocardial injury: Acute and chronic pathophysiological mechanisms



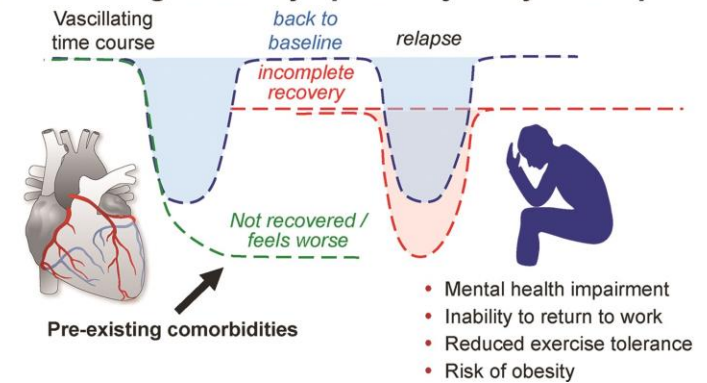
## B Cardiovascular sequelae



## C Long term cardiovascular outcomes

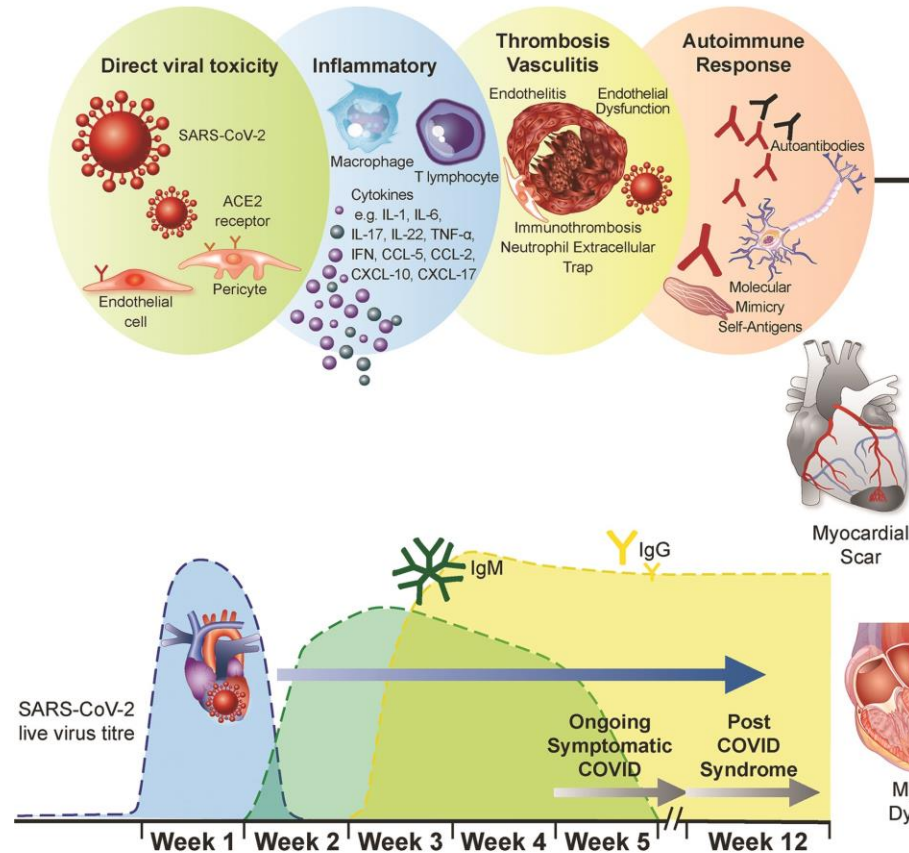


## D Long COVID symptom trajectory and impact

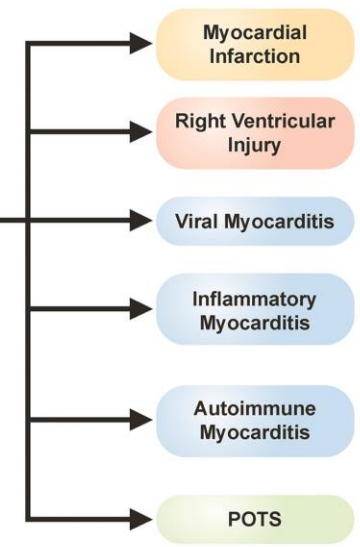


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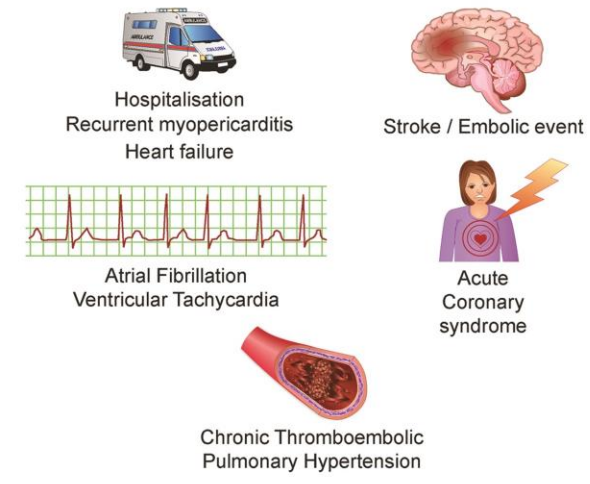
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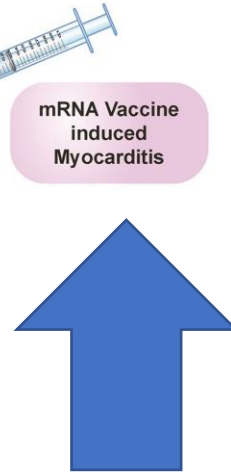
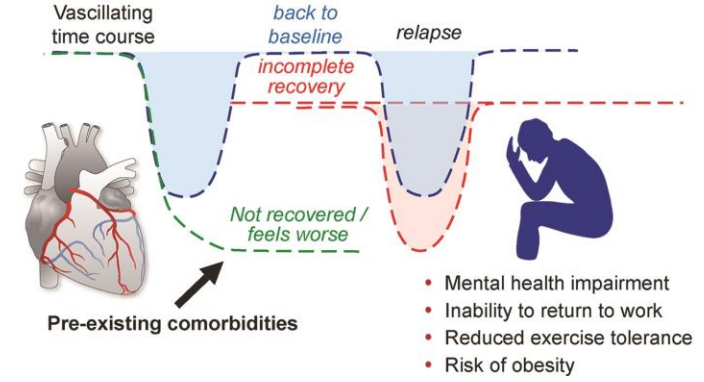
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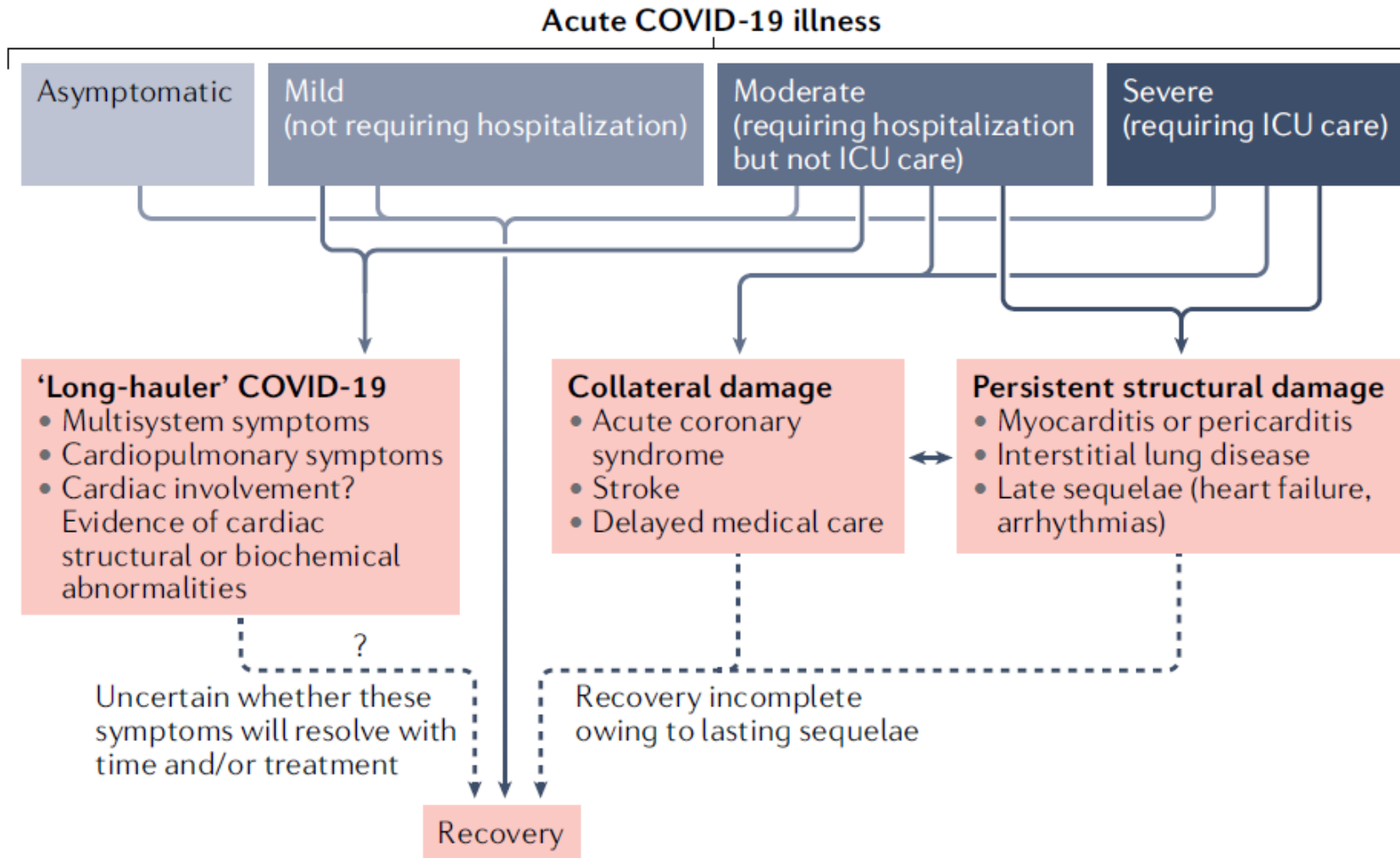
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mRNA Vaccine induced Myocarditis

Vaccination reduces the risk of Myocarditis

# Acute Severity Influences Recovery



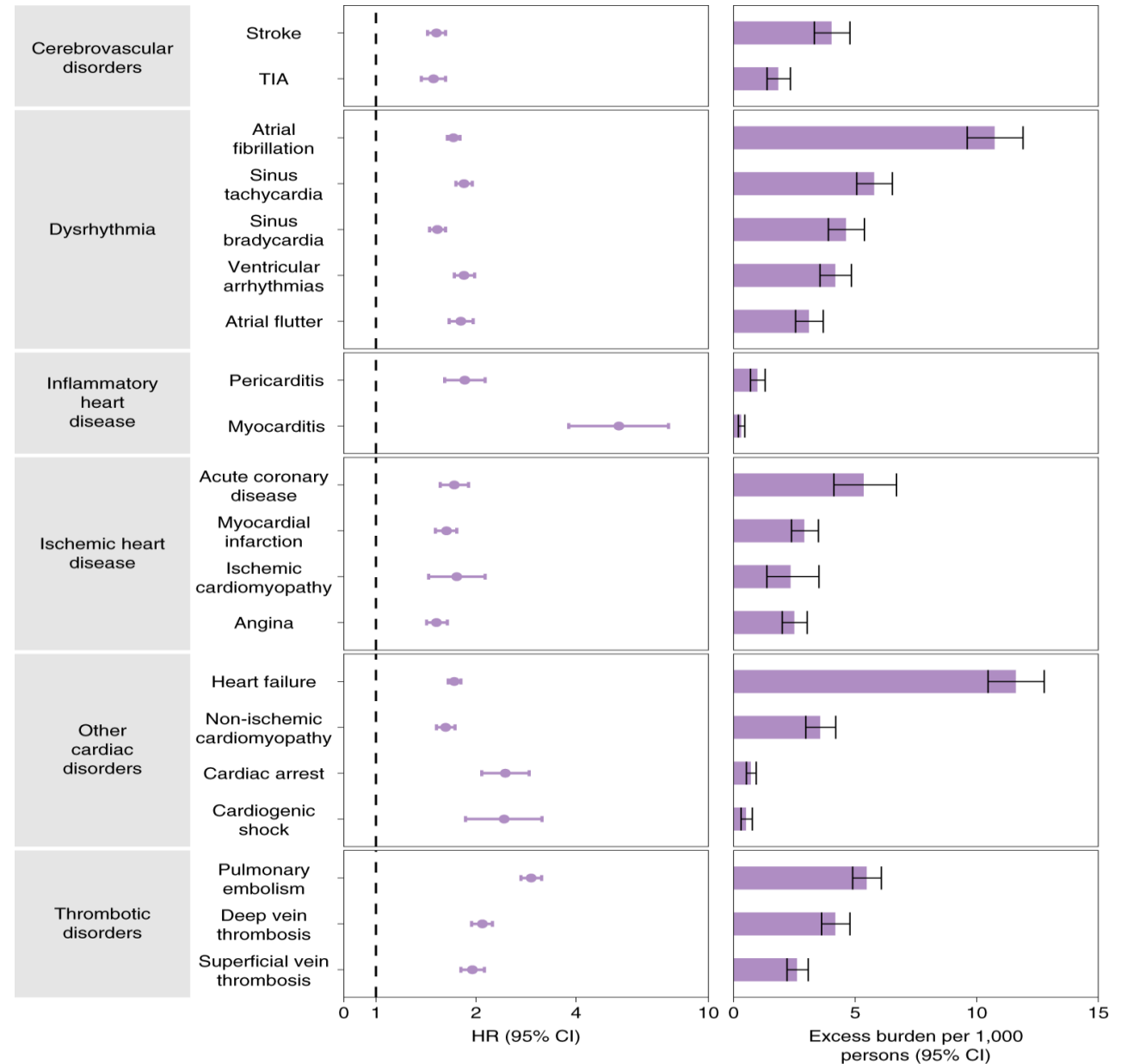
## VA Health system

153,760 Covid 19 patients were compared to 5.5 million controls.

Survived 30 days post infection  
12 month duration

Risk for each increased in a graded fashion depending on severity of acute illness

Even young, healthy subjects with mild symptoms had increased risk



Xie et al, Nat Med,

2022

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# Cardiac Symptoms of PASC

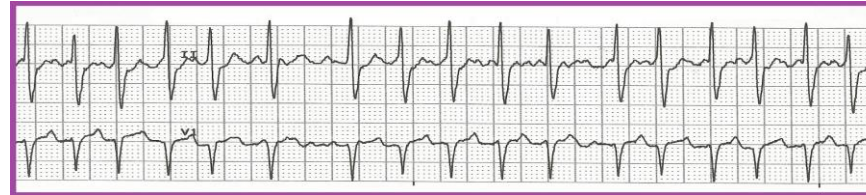
Persistent symptoms may include:

- Dyspnea (40%, 10-70%)
- Palpitations (20%, 9- 68%)
- Dizziness (20%)
- Chest pain (20%, range 10 – 50%)
- Tachycardia at rest (5%)

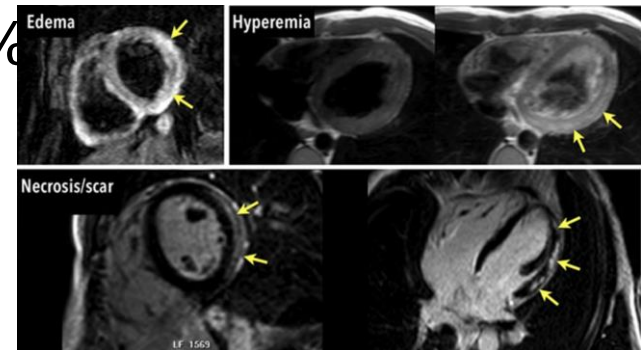


# Specific Cardiac Disorders and PASC

- Arrhythmias (~33%)



- Myocardial Dysfunction/Myocarditis (~22%, 5 to 50%)



- POTS (as high as 30%)

- Pericardial Effusion (~5%, 0.5 to 20%)

- Autonomic Dysfunction (~10%)



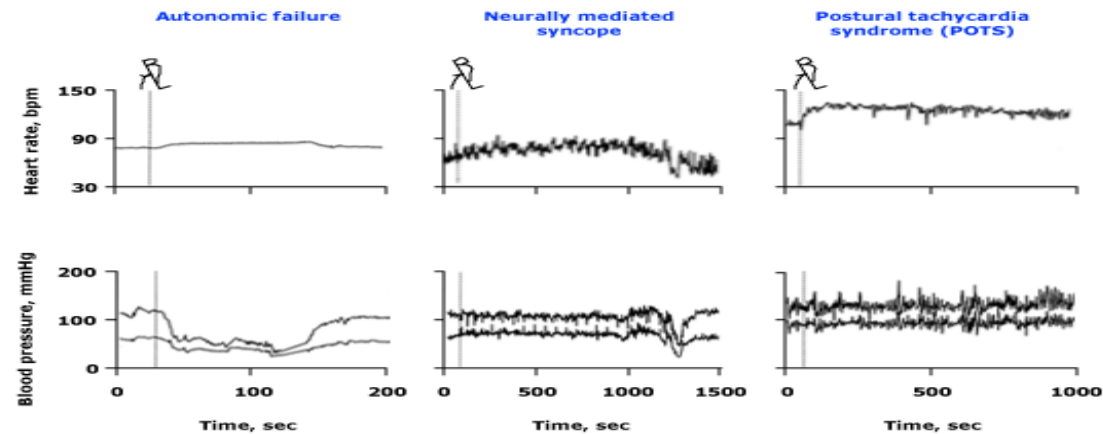
Crook *et al*, *BMJ*, 2021



# Postural Orthostatic Tachycardia Syndrome (POTS) and Tilt Table Testing

Increase in Heart Rate > 30 bpm within 10 minutes or Heart rate > 120 bpm without hypotension

Heart rate and blood pressure patterns observed in head-up tilt table testing



Shown are the heart rate and blood pressure responses seen during tilt table testing in patients with various etiologies of syncope, including autonomic failure, neurally mediated syncope, and postural tachycardia syndrome (POTS). The absence of an appropriate reflex-induced increase in heart rate as the blood pressure falls is a useful clue to the presence of autonomic failure. During neurally mediated syncope, parasympathetic (vagal) activity increases as blood pressure declines, slowing the heart. With POTS, tilt table testing typically reproduces the clinical symptoms in association with a heart rate increase  $\geq 30$  beats/min or a maximum heart rate  $\geq 120$  beats/min within the first 10 minutes; these changes are not associated with hypotension.

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\*POTS is a complex, multi-system, chronic disorder of the autonomic nervous system.

# Consider Conventional Cardiac Disorders As Well

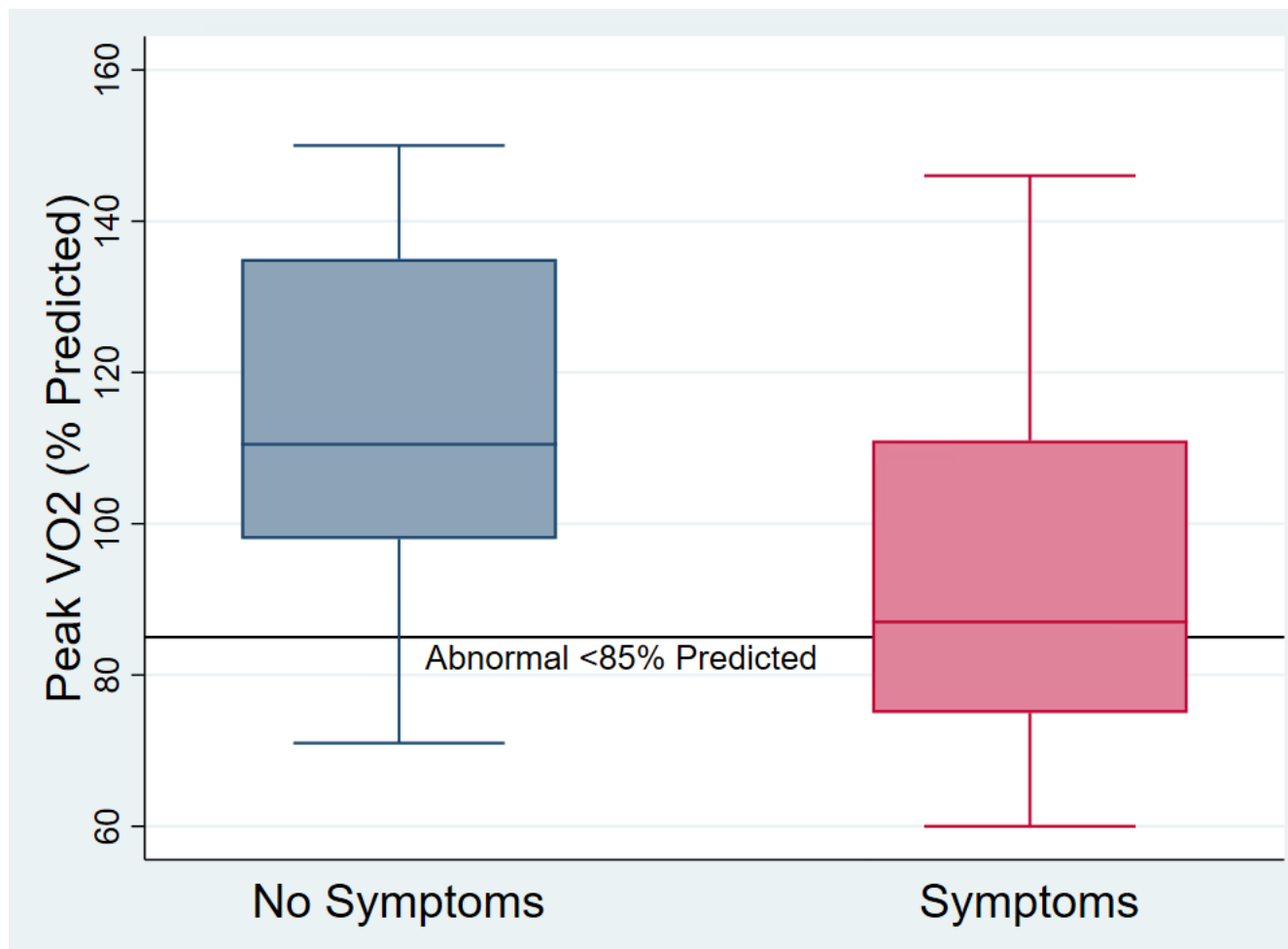
- Approximately half of patients with PASC have comorbid conditions such as obesity, hypertension and diabetes mellitus.
- Many infections like Influenza have also been associated with increased risk for manifesting Cardiac Disease such as MI or Heart Failure.
- In those with Type 2 MI, 55% have underlying coronary artery disease

Pavli et al, Arch Med Res, 2021,  
52:575

# Evaluation of Cardiac Manifestations of PASC

- Examination: rhythm, rub, heart failure
- Laboratories: CRP, troponin
- ECG
- Echocardiogram
- Heart Rhythm Monitor
- Stress Test
- Cardiac MRI
- Tilt Table Test
- 6 minute walk Test
- Cardio-Pulmonary Exercise Test (CPET)

# Exercise Capacity was Reduced on CPET 18 Months after SARS-CoV-2 Infection (n=30)



## **Peak VO<sub>2</sub>**

7.0 ml/kg/min lower with symptoms  
(0.3-13.6; p=0.04)\*  
**=8 METs vs 6 METs**

## **OR for Cardiopulmonary PASC**

1.71 per 1 MET decrease  
(0.91-3.21; p=0.10)\*

## **OR for 2+ symptoms**

3.09 per 1 MET decrease  
(0.97-9.87; p=0.06)\*

\*Adjusted for age, sex, time since SARS-CoV-2 infection, hospitalization for COVID-19, BMI

# Treatment for Cardiac PASC

- Pericarditis: colchicine +/- NSAIDs for 3 months
- Heart failure with reduced LVEF: Guideline Based Medical Therapy
- Arrhythmia: per rhythm disorder.
- POTS: compression stockings, lifestyle, Ivabradine or beta blockers
- Exercise: Recumbent exercise daily. Start with 10 minutes per day and work up gradually (5 Minutes) over weeks to 30 minutes.
- Support: **Reassurance. Death and advanced heart disease are very rare. Confirm that symptoms are real but that time and the options above are likely to show improvement.** There are multiple studies underway to find optimal therapy for the condition.
- First, do no harm.

\*If a person has been diagnosed with Myalgic Encephalomyelitis / Chronic Fatigue Syndrome (ME/CFS), then the NICE (UK guidelines) and CDC recommend against graded exercise. Adaptive pacing technique seems most helpful (PACE trial).

# Take Home Points:

- There are multiple potential mechanisms for Covid 19 infection to manifest cardiovascular disease post infection.
- In PASC, symptoms of dyspnea, chest pain, and palpitations suggestive of cardiac disorders are present in 10 -20% of patients.
- Coincident underlying cardiac disease needs to be considered as well (aka “collateral damage”).
- When non-Covid related disease is excluded, reassurance, rehabilitation, cognitive behavioral therapy are recommended.
- On-going studies regarding pharmacological therapies may offer benefits as well.



Thank You for Your Dedication to Getting Your Patients Through This Pandemic

