

GUIDANCE FROM THE CCS COVID-19 RAPID RESPONSE TEAM

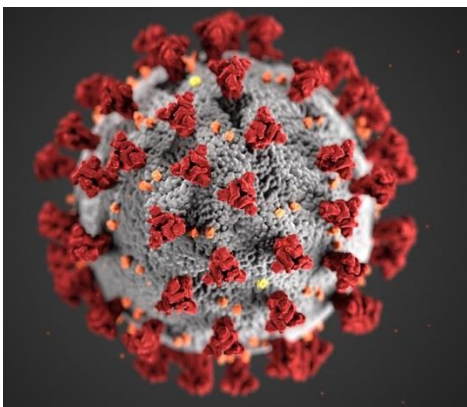
COVID-19 and Cardiovascular Disease: What the Cardiac Healthcare Provider Should Know

March 22, 2020

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 - b) Myocarditis and cardiomyopathy
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1. About the SARS-CoV-2 virus and COVID-19 infection



- ssRNA enveloped virus that binds to ACE2 on lung alveolar cells
 - R_0 is 2-3: the expected number of secondary cases produced by a single (typical) infection in a completely susceptible population
 - Case fatality rate (CFR) ~3.8%
 - Incubation 1-14 days, most patients show symptoms in 3-7 days
 - Disease severity breakdown: 80% mild, 15% severe, 5% critical
 - Mild symptoms include fever, cough, dyspnea, myalgias, fatigue, and diarrhea
- Severe and critical disease includes viral pneumonia, acute respiratory distress syndrome (ARDS), shock, and cytokine storm

2. Acute cardiovascular manifestations

a) Myocardial injury

- i. Myocardial injury defined as an elevation in troponin level is common (7-17%)
- ii. Troponin elevations are more common in severe illness vs non-severe and are associated with worse outcomes
- iii. Mechanism of troponin elevation likely heterogeneous with most representing Type 2 ACS
- iv. No specific therapy has been shown effective in these circumstances
- v. ACC cautions against routinely ordering/trending troponin if it is unlikely to change therapy
- vi. Type 1 ACS is very uncommon in COVID-19 patients

b) Myocarditis and cardiomyopathy

- i. Myocarditis including fulminant forms have been described in several case series and case reports
- ii. No confirmatory pathological specimens showing viral inclusions have been reported
- iii. Severe disease includes a subgroup of patients who reportedly develop a cytokine storm syndrome, including elevated NTproBNP (27.5%), troponin (10%) and interleukin-6 levels
- iv. Recent data from Seattle suggests cardiomyopathy was common (7%), however patients had a high rate of prior congestive heart failure (42%)
- v. Unclear if fulminant myocarditis occurs independent of cytokine storm as an isolated entity, and the degree to which de novo cardiomyopathy occurs in the absence of pre-existing heart failure
- vi. Transthoracic echocardiography (TTE) should be the first line non-invasive test to help support the diagnosis in these patients

c) Arrhythmia

- i. Arrhythmia was reported in up to 16.7% of patients
- ii. Granular details of arrhythmia type are not available presently, and whether this represents the systemic metabolic and inflammatory stressors of severe infection or cardiac disease involvement remains unclear

3. Impact on those with pre-existing cardiovascular disease

- a) Pre-existing cardiovascular disease is common in COVID-19 patients. Hypertension is the most common cardiovascular comorbidity among patients hospitalized with COVID-19.
- b) Prevalent underlying cardiovascular disease is associated with an increased rate of ICU admission, increased disease severity, and mortality
- c) Prevalent cardiovascular disease may represent a degree of immunologic dysregulation, and along with aging may lead to an increased risk of infection susceptibility and severity

4. Approach to the COVID-19 patient

- a) Appropriately personal protective equipment (PPE) is paramount
- b) Donning and doffing protocols should be reviewing and practiced in anticipation of a markedly increased number of cases. Consider assigning a “PPE spotter” on the team/ward to educate and ensure proper donning and doffing (interactive reference below).
- c) Healthcare workers should be familiar with their local hospital and regional protocols for CODE BLUE situations and high-risk of aerosolization procedures such as intubation. Intubation should only be performed by the most experienced airway expert available.

- d) Pragmatic approaches to limit both time of exposure and number of health care personnel should be employed. These may include prescribing once daily medication options if available, limiting the physical examination to necessary components only, limiting cardiac testing, and providing phone consultation when appropriate.
- e) The ACC currently recommends an echocardiogram for patients with biochemical or ECG evidence of myocardial injury. A detailed statement from the Canadian Society of Echocardiography (CSE) to help guide Echocardiography Labs is forthcoming.

5. Treatment of the COVID-19 patient

- a) There are numerous biologically plausible therapies being considered for treatment of COVID-19, but insufficient evidence to support any of their use outside of evaluative studies, which are rapidly evolving and ongoing
- b) As of March 22, 2020, no specific therapy is known to be effective for COVID-19-related cardiac injury. It is reasonable to treat these patients similar to current practice around non-specific troponin elevation in the ICU.
- c) For adults with COVID-19 and shock, we recommend norepinephrine as first line therapy (not dopamine), and adding vasopressin as a second-line agent, over titrating norepinephrine dose. Based on currently available data, we recommend usual management strategies of myocarditis-induced cardiogenic shock/septic cardiomyopathy.
- d) Some experimental therapies being used for COVID-19 have known cardiovascular toxicities and/or interact with cardiovascular medications¹
 - i. Azithromycin, hydroxychloroquine and lopinavir/ritonavir can cause QTc prolongation and resulting Torsade de Pointes.
 - ii. Lopinavir/ritonavir is a potent liver enzyme (CYP3A4) inhibitor and can interact with antiplatelets, oral anticoagulants, digoxin, statins, and many others.
 - iii. See <http://www.covid19-druginteractions.org/> or speak to your pharmacist for updated guidance
- e) As there is no clearly defined COVID-related viral myocarditis, there is no evidence-based indication to provide steroids to those with presumed myocarditis outside of the clinical entity of cytokine storm at this point.
- f) If immunomodulating agents are being considered in fulminant myocarditis, involvement of multiple specialties on a case by case basis is recommended.
- g) Please see the [CCS website](#) for guidance on use and safety of cardiovascular medications. In general, guideline-directed medical therapy for any pre-existing cardiovascular disease should NOT be altered in the absence of a compelling rationale.

6. How COVID-19 may affect delivery of cardiovascular care to non-infected patients

- a) Patients in Hong Kong with STEMI delayed seeking medical attention for up to 4 hours longer, presumably due to concern regarding COVID-19
- b) Chinese hospitals developed rapid access chest pain clinics for those with unclear infectious status and provided telehealth when appropriate
- c) Patients presenting with isolated chest pain and low/no suspicion of COVID-19 were immediately sent to a separate urgent cardiac care clinic to decant ER
- d) Chinese hospitals developed protocols resulting in primary thrombolysis of STEMI patients where primary PCI was previously performed due to concerns of catheterization laboratory

activation delays and health care worker exposure. A detailed statement from the Canadian Association of Interventional Cardiologists (CAIC) is forthcoming

- e) It remains unclear if Canada will experience the same issues with delivery of urgent cardiac care during the pandemic. Contingency and scenario planning is actively underway.

7. Additional resources

Clinical guidance, front-line clinical perspectives and more

- [ACC's COVID Hub](#)
American College of Cardiology

How to conduct a safe echocardiogram

- [COVID-19 Preparedness for Echo Labs: Insights from the Frontlines](#)
American Society of Echo
Recording of webinar held Thursday, March 19th (also posted at www.csecho.ca)

Managing critically ill adults with COVID-19 in the intensive care unit (ICU)

- [Surviving Sepsis Campaign: Guidelines on the Management of Critically Ill Adults with Coronavirus Disease 2019\(COVID-19\)](#)
Society of Critical Care Medicine

Clinical perspectives

- [The Chinese Experience of the Cardiovascular Effects of COVID-19](#)
Chinese Cardiac Association and the American College of Cardiology
Recording of webinar held Friday, March 20th

Infection prevention and control guidance for hospitals and healthcare workers

- [Infection prevention and control for coronavirus disease \(COVID-19\): Interim guidance for acute healthcare settings](#)
Preliminary edition of infection prevention and control guidance for COVID-19, Public Health Agency of Canada
- [Prévention et contrôle de la maladie à coronavirus \(COVID-19\) : Lignes directrices provisoires pour les établissements de soins actifs](#)
Version provisoire des lignes directrices en matière de PCI portant sur la maladie à coronavirus (COVID-19), Agence de la santé publique du Canada

Proper donning and doffing procedures for PPE

- [Donning and doffing of PPE](#) (video)
Trillium Health Partners
- [PPE gowning and degowning](#) (video)
Unity Health Toronto
- [The correct order for putting on and the safe order for removal and disposal of PPE](#) (video)
NHS Scotland
- During cardiac emergencies in the cathlab with patients with COVID
[COVID and urgent cardiac procedures at Imperial College NHS Trust](#) (video)
- [Personal Protective Equipment, Contact and Droplet, COVID-19](#) (self-directed learning)
Alberta Health Services
- [Steps to put on personal protective equipment \(PPE\)](#) (poster, English)
[Étapes pour enfiler l'équipement de protection individuelle \(EPI\)](#) (poster, French)

[Steps to take off personal protective equipment \(PPE\)](#) (poster, English)
[Étapes pour retirer l'équipement de protection individuelle \(EPI\)](#) (poster, French)
World Health Organization

References

1. Driggin E, Madhavan MV, Bikdeli B, et al. [Cardiovascular Considerations for Patients, Health Care Workers, and Health Systems During the Coronavirus Disease 2019 \(COVID-19\) Pandemic](#). *Journal of the American College of Cardiology*. 2020.
2. Xiong TY, Redwood S, Prendergast B, Chen M. [Coronaviruses and the cardiovascular system: acute and long-term implications](#). *Eur Heart J*. 2020.
3. Zeng J, Huang J, Pan L. [How to balance acute myocardial infarction and COVID-19: the protocols from Sichuan Provincial People's Hospital](#). *Intensive Care Med*. 2020.
4. Tam CF, Cheung KS, Lam S, et al. [Impact of Coronavirus Disease 2019 \(COVID-19\) Outbreak on ST-Segment-Elevation Myocardial Infarction Care in Hong Kong, China](#). *Circ Cardiovasc Qual Outcomes*. 2020:CIRCOUTCOMES120006631.
5. Zheng YY, Ma YT, Zhang JY, Xie X. [COVID-19 and the cardiovascular system](#). *Nat Rev Cardiol*. 2020.

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This is a living document with anticipated updates. Please use discretion as data evolves quickly and inaccuracies may exist. A background slide set with further details is available online on request (email nmoulson@alumni.ubc.ca or rostontm@alumni.ubc.ca).

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