Canadian Cardiovascular Society

GUIDANCE FROM THE CCS COVID-19 RAPID RESPONSE TEAM

Long COVID-19: A Primer for Cardiovascular Health Professionals

March 12, 2021

Topics covered:

1. Background

Cardiac Complications of COVID-19

As of March 2, 2021, an estimated 870,000 Canadians have been infected by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), including over 22,000 known deaths.[1] Cardiac injury, defined as an elevation in serum troponin, has been documented in up to 45% of inpatients with COVID-19[2] and has been linked to worse outcomes.[3] It is also postulated that this type of injury may be linked to symptoms that persist following resolution of acute infection, as part of the syndrome commonly referred to as “Long COVID-19”. *The purpose of this document is to provide guidance to health care providers on the optimal management of patients with suspected cardiac complications of Long COVID-19.* It must be recognized that this is an evolving area with little data, at present, to guide management.

Several potential mechanisms for myocardial injury secondary to SARS-CoV-2 infection have been proposed, including: i) myocarditis from either direct viral toxicity and/or bystander immune damage; ii) myocardial ischemia from microvascular thrombosis; and/or iii) COVID-19-related hypoxemia.[4] More recently, histopathological data from COVID-19 patients undergoing endomyocardial biopsy or autopsy suggest that myocarditis is present in only 4.5%.[5] However, it is unclear if any of these cardiac manifestations during acute COVID-19 lead to significant long-term consequences.

Small cohort studies of recovered patients utilizing cardiac MRI have reported conflicting results,[6-8] further highlighting the need to better elucidate potential long-term cardiac sequelae of COVID-19, especially as it pertains to patient symptoms and functional impairments. Furthermore, no data presently exist to support or refute the cardiovascular impact of COVID-19 in patients with or without pre-existing cardiac conditions.

2. Long COVID-19 (also known as COVID-19 long-haulers; chronic COVID-19)

It is now widely recognized that COVID-19 illness can be associated with significant intermediate and potentially longer-term physical limitations. National survey data from the United Kingdom reported 21% of respondents with COVID-19 exhibit symptoms for longer than 5 weeks and 10% exhibit symptoms for greater than 12 weeks.[9] The term "Long COVID-19" is used to define any patient with persistent symptoms after acute COVID-19 (i.e. after 4 weeks) (Table 1).

Table 1. The UK National Institute for Health and Care Excellence (NICE) proposed definitions of COVID-19 illness.

Definition	Duration of Sign or Symptoms
Acute COVID-19	• lasting up to 4 weeks
Ongoing symptomatic COVID-19	• lasting 4 to 12 weeks
Post COVID-19	• starting during or after the illness, but lasting more than 12 weeks

There is a lack of high-quality data on the prevalence of symptom subtypes in patients with Long COVID-19. Fatigue and shortness of breath are commonly reported, affecting up to 98% and 85% of patients respectively, among other multisystem symptoms.[10] Chest pain or palpitations have been reported in 10-44% of cases and are potentially more common at 4-12 weeks post COVID-19 infection.[10,11]

A growing awareness of the impact of COVID-19 infections has led to the formation of several online patient-initiated Long COVID-19 support groups and, more recently, ambulatory clinics specializing in the care of these patients. Generally, cardiac

specialists have either been integrated into these clinics or have provided consultation on an ad hoc basis. Thus, the following recommendations are largely based on expert opinion and the current collective experience.

3. Potential Long COVID-19 Scenarios Warranting Consultation with Cardiac Specialists

Patients with diagnosed COVID-19 illness >4 weeks ago and:

(1) **Persistent or new unexplained chest pain**. A cardiac etiology is more likely with multiple cardiac risk factors, documented cardiac injury and/or new Q waves or ST-T wave abnormalities on ECG, during or after initial COVID-19 illness.

(2) **Shortness of breath**. A cardiac etiology is more likely with elevated BNP, left ventricular dysfunction on imaging and/or radiographic evidence of pulmonary edema.

(3) **Frequent palpitations**. A cardiac etiology is more likely if associated with pre-syncope or syncope and/or a significant arrhythmia is detected on Holter or other cardiac monitoring device. For patients with persistent sinus tachycardia, consider a cardiac etiology in the absence of systemic causes (e.g. fever, anemia and hypoxia).

(4) **Postural light headedness**. A cardiovascular etiology is more likely if orthostatic hypotension is documented.

4. Suggested Cardiac Investigations

The Canadian Cardiovascular Society Rapid Response Team has placed an emphasis on physical examination and non-invasive assessment utilising local expertise and continued close surveillance, especially among those with pre-existing cardiac conditions or multi-system disease (Table 2).

Table 2. Symptom-guided investigations for possible cardiac complications of Long COVID-19

Symptom	Suspected Etiologies	Suggested Investigations
Chest pain	• Myopericarditis • Ischemic heart disease	• ECG, cardiac troponin, echo, cardiac magnetic resonance • ECG, functional test for ischemia
Shortness of breath	• Congestive heart failure	• ECG, BNP/NT-proBNP, echo

	• Deconditioning • Pulmonary scarring, thromboembolic disease, pulmonary hypertension	• Pedometer, cardiopulmonary exercise test • Chest X-ray, pulmonary function testing, computed tomography
Palpitations	• Arrhythmia • Inappropriate sinus tachycardia, cardiac dysautonomia	• ECG, Holter • ECG, active standing test
Orthostatic light headedness	• Cardiac dysautonomia	• Postural vital signs • Active standing test

Abbreviations: ECG = electrocardiography, BNP = b-type natriuretic peptide

5. Recommended Treatment

Although there are no specific recommendations for managing cardiac symptoms in Long COVID-19 patients, there is considerable support for maintaining guideline-based goal-directed therapy in patients with pre-existing cardiovascular disease. Patients with new cardiac findings or symptoms should be managed using contemporary treatments, similar to patients without a history of COVID-19 infection (Table 3).

Table 3. Suggested treatments of cardiac-related complications of Long COVID-19

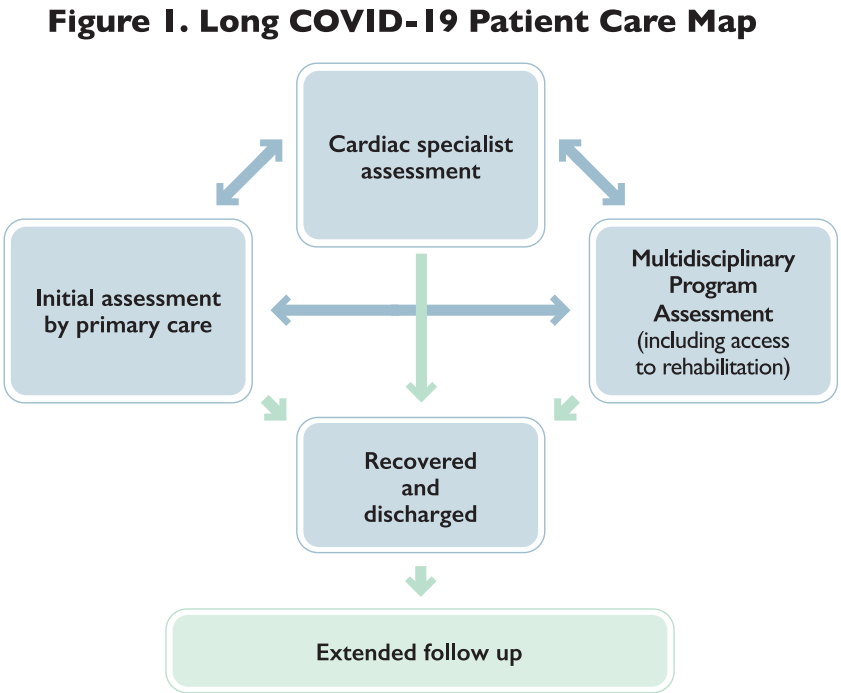
Diagnosis	Possible Treatments
Established cardiovascular disease	Continue with guideline-based goal-directed therapy
Myopericarditis	Nonsteroidal anti-inflammatory drug, colchicine
Cardiac dysautonomia (orthostatic hypotension, persistent sinus tachycardia, Postural Orthostatic Tachycardia Syndrome-like syndrome)	Hydration, salt supplementation, compression garments Selective use of pharmacotherapies, including midodrine, beta blockers, ivabradine

6. Multidisciplinary Care of Patients with Long COVID-19

After careful investigations to identify and treat cardiac and/or pulmonary causes of patient symptoms, many may remain symptomatic with chronic fatigue and tiredness. Although in some individuals these symptoms may be attributed to the slow nature of their recovery following a critical illness, in others it may result from deconditioning and other unrecognised factors. There is no clear relationship between chronicity of symptoms and severity of initial COVID-19 illness. Long COVID-19 patients often report less energy than pre-illness, and everyday situations requiring physical, cognitive and/or emotional stamina may be exhausting in a waxing and waning pattern.

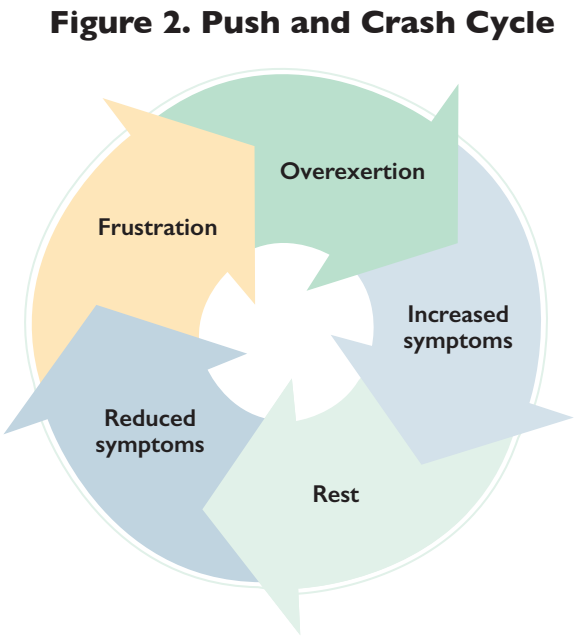
In many patients, a tailored return to exercise can be a useful adjunctive therapy. This requires a multidisciplinary team rehabilitation service consisting of nurses, physiotherapists, physiatrists, exercise specialists, neurologists, psychiatrists, respirologists, rehabilitation experts and cardiologists to co-ordinate an individualised plan. Additional considerations should include baseline health, premorbid function, biomechanical assessments, exercise prescription and a holistic patient review. The Long COVID-19 patient care map illustrated below enables a cycle of “learn-teach and modify” to further refine interventions.

Figure 1. Long COVID-19 patient care map



Return to exercise is often regarded as an important milestone of recovering from COVID-19, resulting in post-exertional malaise (PEM). Many with this syndrome experience a cycle of “push and crash” (Figure 2).

Figure 2. Push and crash cycle



The symptoms of PEM resemble myalgic encephalitis or chronic fatigue syndrome, and typically occur 24-72h post trigger, potentially lasting for several days. The opposite of “push and crash” is pacing. This further emphasizes the importance of early involvement of a multidisciplinary approach to prevent and support “push and crash” candidates to a path of pacing, with reduced suffering, improved sense of control and well-being.

Pacing involves:

- *Finding the individual’s envelope* - paying attention to the level of triggers, which may be physical, emotional or cognitive
- The individual adapting to their envelope - learning to control triggers
- *Expanding their envelope* - gradual progression and adaptation

The management strategies proposed above for Long COVID-19 have not yet been evaluated in clinical trials. However, these recommendations appear reasonable given current knowledge and experience. Future work on COVID-19 should continue to

assess knowledge gaps and evaluate the long-term cardiovascular effects and potential impact on patient wellness and survival. Furthermore, long-term outcomes should also be studied in asymptomatic, recovered COVID-19 patients to determine any potential links to latent cardiovascular disease.

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