National Comprehensive Guidelines for Management of Post-COVID Cardiovascular Sequelae

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Guidelines on Post-COVID Cardiovascular Sequelae

Background

As we enter the second year of pandemic, patients with ongoing symptoms after recovery from COVID-19 are increasingly recognized as a growing population in need of attention. It has been found that many patients have been experiencing short to long-term sequelae of the disease. Some patients have residual sequelae/symptoms which may or may not be causally linked to COVID-19. In the absence of universally accepted definition, Post-COVID Syndrome by consensus is defined as signs and symptoms that develop during or after an infection consistent with COVID-19 which continue for more than 12 weeks and are not explained by alternative diagnosis. Recent literature also divides Post-COVID patients into subacute or ongoing symptomatic COVID (4-12 weeks beyond acute COVID-19) and chronic COVID or Post-COVID syndrome (symptoms persisting beyond 12 weeks of onset of acute COVID-19). Another terminology which is in vogue is the ‘Long COVID’ that is defined by National Institute for Health and Care Excellence as symptoms that continue or develop after acute COVID-19. The time line of COVID-19 phases and their definitions are shown in figure 1.

![Figure 1: Terminology and Definition of Long Covid](image-url)
Scope of this document

This document focuses on cardiovascular sequelae of COVID-19, their clinical presentation, early diagnosis and treatment. It also briefly highlights the strategies for prevention of cardiac complications in addition to the common do’s and don’ts during post COVID-19 period.

Cardiovascular sequelae Post-COVID

Cardiovascular sequelae not only occur in symptomatic COVID-19 patients but have also been reported in asymptomatic patients. Up to 20%–30% of patients hospitalized with severe COVID-19 have evidence of myocardial involvement manifested by elevated troponin levels, venous thrombo-embolism, heart failure and arrhythmias. Elevated troponins in acute symptomatic patients have been associated with poor outcomes and higher in hospital mortality rates. There are multiple mechanisms proposed to explain cardiovascular complications of COVID-19. Direct cardiomyocyte damage or damage secondary to hypoxia, microvascular dysfunction, thrombosis, and cytokine storm have been implicated. Given the high prevalence of cardiac injury, it is reasonable to expect a spectrum of heart disease with some residual post myocarditis abnormalities in severe cases. Myocardial involvement is presumed to be the initiator of inflammatory process and subsequent fibrosis (detectable on cardiac magnetic resonance imaging) and long-term sequelae too. The long-term sequelae include increased cardiometabolic demands, myocardial fibrosis or myocardial scar, persistent left ventricular dysfunction, heart failure, arrhythmias, inappropriate sinus tachycardia and autonomic dysfunctions.

Many of the lingering signs and symptoms in patients after recovery from COVID-19 especially fatigue, dyspnea and chest pain — are non-specific. This may occur denovo in an asymptomatic COVID-19 patients or in symptomatic COVID-19 patients with no clinically apparent cardiac involvement during the acute phase. Patients who develop viral myocarditis, myocardial infarction, pulmonary embolism, stress induced myocardial injury and arrhythmias during the acute phase are at higher risk of developing long-term cardiovascular complications and poor outcomes. These subsets of patients typically have comorbidities such as diabetes, hypertension, obesity, dyslipidemia and chronic kidney disease which would complicate their recovery after the acute phase.

Chest pain has been reported in ~20% of COVID-19 survivors at sixty-day follow-up. Palpitations have reported in ~10% of COVID-19 survivors at sixty-day follow-up. Ongoing chest pain and palpitations have been reported in 5% and 9% respectively at six-month follow-up post-acute COVID-19. Stress cardiomyopathy is 4-5 times more common during...
the COVID-19 pandemic when compared to pre-pandemic periods (7.8% versus 1.5-1.8%). Myocardial inflammation detected on cardiac MRI was found in as many as 60% of affected people more than 2 months after a diagnosis in one study. However, such high prevalence of myocardial involvement has not been replicated in other studies and the clinical implications, if any, of these findings is not known. Retrospective studies have found the rate of venous thromboembolism in the post-acute COVID-19 setting to be <5%. However, the vast majority of patients who have asymptomatic/mild COVID-19 do not have any serious sequelae. Case control studies have shown no excess cardiac involvement in survivors of COVID-19 infection as compared to controls.

**Clinical features: Signs and symptoms**

Profound fatigue is the most common symptom in most people with Long COVID. Other symptoms such as chest pain, dyspnea and palpitations are well described symptoms in patients with cardiac sequelae. Chest pain consistent with typical angina should be differentiated from atypical or non-anginal chest pain on the basis of location, aggravating and relieving factors. Likewise, respiratory causes of dyspnea need to be differentiated from cardiac causes. Heightened suspicion of dyspnea of cardiac origin especially in the setting of acute coronary syndrome, pulmonary embolism, myocarditis and tachyarrhythmias is the key for early diagnosis of worsening cardiac status and initiating appropriate treatment. Palpitations in Post-COVID syndrome could be due to inappropriate sinus tachycardia, postural orthostatic tachycardia syndrome consequent to hyperadrenergic state or premature ventricular contractions or ventricular arrhythmias consequent to myocardial fibrosis and scarring. Syncope of neurological origin has to be differentiated from that of cardiogenic causes by detailed history, meticulous examination and pertinent investigations like ECG and Holter examination. Heart failure should be suspected in patients with heart disease (Pre-COVID or during acute infection) having tachycardia, neck vein distention, dyspnea, orthopnea, paroxysmal nocturnal dyspnea, pedal edema, hepatomegaly, a left ventricular third heart sound.

**Investigations**

Patients with cardiovascular complications during acute infection or those experiencing persistent cardiac symptoms may be monitored with serial clinical, electrocardiogram and echocardiogram evaluations during follow-up. An algorithm to identify patients with cardiac injury during acute and convalescent phase is shown in figure 2. Patients evaluated at Post-COVID clinics with persistent cardiac symptoms described above should undergo chest radiograph, ECG and cardiac biomarkers (Troponins/NT-pro-BNP) to assess cardiovascular involvement.
Additional diagnostic tests such as echocardiography, cardiac MRI, cardio-pulmonary exercise testing, rhythm monitoring by Holter, chest CT and lower extremity Doppler testing maybe indicated based on symptoms and screening investigations.

**Figure 2:** Recommendations to identify patients with cardiac injury during acute and convalescent phase.


**Management**

The management of patients with Post-COVID cardiovascular complications depends on the status of pre-existing cardiac comorbidities and the cardiac condition developed during the acute phase (myocardial infarction, pulmonary embolism, tachyarrhythmias etc) or during recovery. Common do’s and don’ts during Post COVID period have been summarized in table 1.
### Table 1: Common do’s and don’ts during Post-COVID period

<table>
<thead>
<tr>
<th>Do’s during Post COVID period</th>
<th>Don’ts during Post COVID period</th>
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<tbody>
<tr>
<td>• Frequent hand washing and social distancing</td>
<td>• Persistent symptoms (such as fatigue, cough, breathlessness, fever): limit activity to 60% of maximum heart rate (220-age in years) until 2-3 weeks after symptoms resolve</td>
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<tr>
<td>• Restructure routines at home</td>
<td>• Intense cardiovascular exercise in known cardiac patients and all cardiovascular training in case of athletes to be avoided for 3 months.</td>
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<td>• Greater emphasis on healthy weight</td>
<td>• Do not stop medications or take over the counter medications without consulting your cardiologist</td>
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<tr>
<td>• Healthy eating habits</td>
<td>• Do not ignore warning signs such as high grade fever, oxygen saturation &lt; 93%, chest pain, dizziness, syncope or palpitations.</td>
</tr>
<tr>
<td>• Moderate intensity exercise (30 minutes per day- 5 times a week)</td>
<td>• Practice meditation, Yoga within your tolerance limits</td>
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<tr>
<td>• Avoid alcohol</td>
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<tr>
<td>• No smoking or tobacco products</td>
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<tr>
<td>• Avoid self-medication</td>
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<tr>
<td>• Arrange for telemedicine contacts for follow up with physician/cardiologist</td>
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<tr>
<td>• Vaccination after 3 months post recovery if not vaccinated prior</td>
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<tr>
<td>• Important to control HT, DM and dyslipidaemia. Follow guideline directed medical therapy for cardiovascular risk factors like HT, DM, dyslipidaemia and cardiac conditions as prescribed by physician/cardiologist</td>
<td></td>
</tr>
<tr>
<td>• Practice meditation, Yoga within your tolerance limits</td>
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</table>

Impact of cardiopulmonary exercise in Post-COVID patients is not clearly known yet. However, general rules that are applicable to this subset of patients include one week of low level stretching and strengthening before exercise in patients with mild COVID-19 post recovery. In presence of mild Post-COVID symptoms, limiting exercise to slow walking and increasing rest period if symptoms worsen would be recommended. In patients with persistent symptoms (such as fatigue, cough, breathlessness, fever), limiting activity to 60% maximum heart rate (220-age in years) until 2-3 weeks after symptoms resolve. Intense cardiovascular exercise is to be avoided in all patients for 3 months. Athletes are advised to take three months of complete rest from cardiovascular training followed by specialist follow-up, with return to sport guided by functional status, biomarkers, absence of dysrhythmias, and evidence of normal left ventricular systolic function.
Patients with cardiac comorbidities/conditions such as diabetes mellitus, hypertension, obesity, atrial fibrillation and prior myocardial infarction and heart failure should be managed meticulously as per guideline directed medical therapy. Patients with cardiovascular diseases should be on statins, antiplatelet drugs in addition to the drugs for management of their risk factors including hypertension and diabetes. Adequate treatment of cardiac risk factors such as diabetes, hypertension, obesity and dyslipidemia in addition to the lifestyle modifications described above is the need of the hour in this ongoing pandemic to not only avoid development of new cardiac complications, but also preventing decompensation in those with pre-existing heart disease. Serial follow up of these patients biannually or annually is the key to ensure drug compliance and avoid further major adverse cardiac event.

Focusing on patients with heart failure with reduced ejection fraction, the nonpharmacological treatment in people with congestive heart failure include educating people about self-management, limiting dietary sodium to < 2g/day and fluid intake to < 2 L/day (1.5 L for severe CHF), explaining the symptoms of dyspnea, edema and bloating and smoking cessation. They are advised to report or reach through telemedicine to their cardiologist for worsening symptoms and for regular follow-up. Prior experience suggests higher risk of cardiovascular events after severe viral infections in patients with cardiovascular disease. Data from the ongoing pandemic is scarce as of now and it is encouraged to get vaccinated for COVID-19 and pneumococcal disease. Guideline directed medical therapy for heart failure includes beta blockers, Angiotensin Converting Enzyme Inhibitors (ACE inhibitors)/Angiotensin Receptor-Neprilysin Inhibitor (ARNi)/ Angiotensin Receptor Blockers (ARB), mineralocorticoid receptor blockers and diuretics. Patients with atrial fibrillation will require anticoagulation for stroke prevention as dictated by CHA2DS2Vasc score. Patients with confirmed DVT/pulmonary embolism require anticoagulation prophylaxis preferable with novel oral anticoagulants or warfarin to maintain the INR (International normalized ratio) in the range of 2-3.

**Conclusion**
COVID-19 impacts cardiovascular system in the recovery phase and is part of the overall Post-COVID syndrome. Physicians managing Post-COVID clinics should be aware of these symptoms and cardiovascular implications of COVID-19 sequelae. Discrete screening, appropriate investigations and evidence-based treatment of cardiovascular Long COVID is mandated to reduce long term impact of COVID-19.