Editorial

A Short Review of Cardiac Manifestations of COVID 19 Diseases

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ABSTRACT

The COVID-19 pandemic has created many complex challenges for cardiologists. Many patients with COVID-19 illness have underlying cardiovascular (CV) disease or develop acute cardiac injury during the illness. The presence of underlying cardiovascular comorbidities in COVID-19 patient is associated with high morbidity and mortality. COVID-19 infection itself can induce myocardial injury, acute coronary syndrome, arrhythmia, and venous thromboembolism. Diagnostic workup during COVID-19 infection includes electrocardiography, and cardiac biomarker evaluation (troponin, CK-MB, BNP, D-Dimer) for patients with suspected cardiovascular manifestations. This review demonstrates the current understanding of cardiovascular complications in COVID-19 infected patients, their pathophysiological mechanisms and management. Non-invasive functional imaging for myocardial ischemia such as coronary computed tomography angiography, or invasive coronary angiography combined with functional evaluation is recommended as the initial strategy to diagnose CAD in symptomatic patients. Guideline directed management to be continued for co-morbidities like diabetes mellitus, systemic hypertension, chronic obstructive lung disease, chronic coronary artery disease, chronic heart failure.

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Background

According to the latest reports, 20–51% of COIVD-19 infected patients were reported to have at least one comorbidity, with diabetes (10–20 %), hypertension (10–15 %) and other cardiovascular and cerebro vascular diseases (7–40 %).[1-3]

The pre-existing cardiovascular disease is an independent determinant of higher morbidity and mortality risk with COVID-19 illness.[4, 5] The interaction between viral spike (S) protein and ACE 2, which triggers virus entry into the host cells, is likely to be involved in cardiovascular manifestations.[6] The high burden of inflammation associated with COVID-19 is proposed to accelerate the development of subclinical disorders or cause de novo cardiovascular damage.

Cardiac Manifestations of COVID 19 disease:

Acute cardiac injury:

It occurs in ~60% of hospitalized cases with severe COVID-19 illness. The contributors include (1) acute changes in myocardial tissue demand and supply due to tachycardia, hypotension, and hypoxemia; (2) acute coronary syndrome milieu; (3) microvascular dysfunction due to diffuse microthrombi; (4) stress-related cardiomyopathy (5) nonischemic myocardial injury; or (6) direct viral cardiomyocyte toxicity.

Guo *et al.*[7] observed that among 187 patients hospitalized with COVID-19, 52 (27.8 %) exhibited myocardial injury as demonstrated by elevation of cardiac troponin T (cTnT). In-hospital mortality was more than 6-fold higher in patients with elevated cTnT levels than in patients with normal cTnT levels (59.6 % Vs 8.9 %).

Acute COVID 19 infection has various effects on the cardiovascular system:

- Acute coronary syndrome
- Myocarditis
- Heart failure
- Arrhythmias

Acute Coronary Syndrome (ACS):

Despite being eclipsed by Covid-19, the acute coronary syndromes are still an important cause of morbidity and mortality and should not be overshadowed, especially because of the possible physio pathological links (currently unexplored) with Covid-19 infection and the underestimation of ACS cases during Covid-19 pandemic. More data are needed to estimate the real prevalence of ACS during the pandemic. The symptoms and presentation of acute myocardial infarction may be overshadowed in the context of coronavirus infection. Patients should be treated with standard drug therapy such as aspirin, statins, beta-blockers, and angiotensin-converting enzyme inhibitors like non covid cases.

ACS management-

For low-risk STEMI patients, thrombolysis is the choice of reperfusion strategy. Cardiac catheterization should be carried out as a rescue procedure if thrombolysis fails.

For high-risk STEMI cases, the treating personnel should take utmost precaution and use full personal protective equipment (PPE) to proceed with primary percutaneous coronary intervention (PCI).

NSTEMI/Unstable Angina: Conservative management should be continued till the patient completes isolation period for the disease. If the patient deteriorates in terms of worsening angina, heart failure, arrhythmia should be taken up for invasive coronary management with full PPE to all catheterization laboratory staffs.

Myocarditis:

More than 7% of cases with COVID-19 are reported to have this type of acute cardiac injury.[8] Myocarditis is caused by direct infiltration of virus but can also be secondary to severe hypoxia and the "cytokine storm."

Diagnosis of Myocarditis in COVID-19 is made by:

•Electrocardiogram - Sinus tachycardia, with diffuse ST-T changes.

•Elevated troponin I or T

•Elevated brain natriuretic peptide (N-terminal pro BNP) or BNP.

• Echo heart- Normal to Enlarged left ventricle with low Left Ventricular Ejection Fraction and global LV dysfunction.

Management of myocarditis-

Management of myocarditis requires standard heart failure medications, ventilatory support and extra corporeal membrane oxygenation (ECMO) in severe shock patients.

Heart Failure:

Heart Failure may result from myocarditis and ACS. Patients of covid 19 disease may present with heart failure due to new-onset atrial fibrillation. Elevated levels of amino-terminal pro-B-type natriuretic peptide were identified in 49 % of patients. In advanced stages of COVID-19, the immune system's response to infection might trigger the development of stress-induced cardiomyopathy and cytokine-related myocardial dysfunction. Significantly elevated BNP/NT-pro BNP levels suggest acute HF. Patients with chronic HF should continue guideline-directed medical therapy irrespective of COVID-19 illness. Management includes guideline directed heart failure therapy like angiotensin converting enzyme inhibitor (ACEI) / angiotensin receptor blocker (ARB) / angiotensin receptor neprilysin inhibitor (ARNI), beta blocker, Diuretics, sodium glucose co-transporter-2 (SGLT 2) inhibitor, mineral corticoid receptor antagonist (MRA). Comorbidities like diabetes, hypertension should be managed

aggressively. Atrial fibrillation must be managed medically.

Arrhythmias and sudden cardiac arrest: Arrhythmia and sudden cardiac arrest can be one of the cardiac manifestations. Palpitations have been reported to be presenting symptom of COVID-19 patients without fever and cough. In Patients with COVID-19, cases with elevated levels of troponin T are likely to develop arrhythmias, like ventricular tachycardia, and fibrillation than normal troponin T. Atrial and ventricular level tachycardia and fibrillation can be triggered by myocardial injury, fever, sepsis, hypoxia, and electrolyte abnormalities. Patients with advanced COVID-19 disease are often treated with antiviral medications and antibiotics that are known to induce arrhythmias.

Conclusions

- Patients with underlying cardiovascular diseases and cardiovascular risk factors are predisposed for COVID-19 with worse prognosis.
- The possible mechanisms of cardiovascular injury are endothelial dysfunction, diffuse microangiopathy with thrombosis, and increased angiotensin II levels.
- Hyperinflammation in the myocardium can result in acute coronary syndrome, myocarditis, heart failure, cardiac arrhythmias, and sudden death.
- The higher levels of cardiac troponins and natriuretic peptides in the early stage of COVID-19 reflects the acute myocardial injury.
- The association between COVID-19 and cardiovascular manifestations requires in-depth understanding for appropriate management of the patients.
- Till the time a specific antiviral drug is available for COVID-19, treatment remains symptomatic.
- Thus, patients require clinician's meticulous attention towards the cardiovascular system and comprehensive treatment.

Recommendations:

COVID-19 patients in whom ACS is suspected should be directed to the hospitals offering 24/7 PCI-mediated reperfusion therapy. Specific protocols to balance infective risks related to COVID-19 and optimal ACS management should be implemented (especially for STEMI), without delays and with preferential PCI treatment whenever possible.

A dedicated Echocardiogram machine within the isolation ward, where COVID 19 patients are being treated, would be preferable. Patients with COVID-19 who are required to come to the catheterization laboratory should take appropriate

regulations along with members of the catheterization laboratory team. Intubation, suction, and active CPR can result in the aerosolization of respiratory secretions, thus increasing medical personnel exposure. The threshold to consider intubation in a patient with borderline respiratory status may need to be lowered and should preferably be done prior to transfer to avoid emergency intubation in the catheterization laboratory.

References:

1. Huang C, Wang Y, Li X, et al. Clinical features of patients with 2019 novel coronavirus in Wuhan, China. Lancet. 2020; 395: 497–506.

2. Kui L, Fang YY, Deng Y, et al. Clinical characteristics of novel coronavirus cases in tertiary hospitals in Hubei Province. Chin Med J. 2020; in press.

3. Chen N, Zhou M, Dong X, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 2020; 395: 507–513.

4. Baldi E, Sechi GM, Mare C, Canevari F, Brancaglione A, Primi R, Klersy C, Palo A, Contri E, Ronchi V, Beretta G. Out-of-hospital cardiac arrest during the Covid-19 outbreak in Italy. N Engl J Med. 2020 Jul 30; 383(5):496-8.

5. Anderson JL, Morrow DA. Acute Myocardial Infarction. N Engl J Med 2017; 376:2053-64.

6. Bourgonje AR, Abdulle AE, Timens W, Hillebrands JL, Navis GJ, Gordijn SJ, Bolling MC, Dijkstra G, Voors AA, Osterhaus AD, van Der Voort PH. Angiotensin-converting enzyme 2 (ACE2), SARS-CoV-2 and the pathophysiology of coronavirus disease 2019 (COVID-19). The Journal of Pathology. 2020; 251(3): 228-48.

7.Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, Wang H, Wan J, Wang X, Lu Z. Cardiovascular implications of fatal outcomes of patients with coronavirus disease 2019 (COVID-19). JAMA cardiology. 2020; 5(7):811-8.

8. Shaha KB, Manandhar DN, Cho JR, Adhikari A, KC MB. COVID-19 and the heart: what we have learnt so far. Post graduate Medical Journal. 2020; 17.