Rapid review of cardiovascular disease and COVID-19

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Summary

- COVID-19 disease could worsen underlying Cardiovascular Disease (CVD) and even precipitate new cardiovascular events
- Patients with pre-existing CVD appear to have increased vulnerability to be infected with COVID-19 and have more severe form of the disease with worse clinical outcomes
- COVID-19 cases may suffer from acute cardiac injury, arrythmia and heart failure
- SARS-CoV-2 virus appears to affect the myocardium and cause myocarditis and ultimately leads to long term cardiac sequel including reduced systolic function
- It is too early to ascertain the potential long-term consequences of CVD cases who have suffered from COVID-19
- Survivors of Severe Acute Respiratory Syndrome (SARS) reported to have long-term abnormalities of lipids (68%), glucose metabolism (60%) and cardiovascular abnormalities (40%)
- Decrease physical inactivity and increase psychosocial stress due to quarantine and social distancing, could contribute to an increase in the burden of cardiovascular disease during and following the outbreak
- Provision and expansion of the knowledge and infrastructure of e-visits/telehealth in the management of CVD during the outbreak
- Improvement of patient and public education regarding indications for quarantine versus hospital admission for patient requiring cardiovascular health care
- Current recommendation is patients with hypertension should receive treatment with ACEi and ARB according to 2018 ESC/ESH guidelines despite COVID-19 infection status
- Patients with hypertension should continue their home blood pressure medical regimen.

Background

The Coronavirus Disease 2019 (COVID-19) resulting from infection of severe acute respiratory syndrome virus 2 (SARS-CoV-2), has presented an unexpected challenge for the healthcare community across the world. High infectivity, ability of transmission during asymptomatic phase and relatively low virulence have resulted in rapid transmission of this virus beyond geographic regions, leading to a pandemic. The presentation of COVID-19 varies from mild flulike illness to potentially lethal acute respiratory distress syndrome (ARDS). Even though the respiratory tract is the primary target for SARS-CoV-2, the cardiovascular system may get involved in several different ways. SARS-CoV-2 contributes to the risk of cardiovascular events through:

i. Direct myocardial injury: Binding of SARS-CoV-2 to ACE2 can result in alteration of ACE2 signalling pathways, leading to acute myocardial and lung injury (Li et al., 2020; Xiong, Redwood, Prendergast, & Chen, 2020),

ii. Systemic inflammation: It has been reported that severe forms of COVID-19 are characterised by acute systemic inflammatory response and cytokine storm (Huang et al., 2020; Zhou et al., 2020), affect the vascular endothelium (Mahmoudi, Curzen, & Gallagher, 2007), may alter the

haemostatic system resulting in a pro-coagulable state (Sun, 2006), and/or influence atherogenesis and atherosclerosis (Zhu et al., 2000)

iii. Adverse effects of various therapies

iv. Electrolyte imbalances due to interaction of SARS-CoV-2 with renin-angiotensin-aldosterone system leads to hypokalaemia.

So, it is suggested from the above mechanisms that SARS-CoV-2 infections can trigger acute coronary syndromes, arrhythmias and exacerbation or development of heart failure (Madjid, Safavi-Naeini, Solomon, & Vardeny, 2020). Thus, it could worsen underlying Cardiovascular Diseases (CVD) and even precipitate new cardiovascular events. The severity, extent, and short-term vs long-term cardiovascular effects of COVID-19 are not yet known and are subject to scrutiny and investigation. This review is aimed at providing an overview on the impact of COVID-19 infection on pre-existing CVD and new onset cardiac complications.

COVID-19 disease and outcome among CVD patients

It has been reported in the literature, patients with pre-existing CVD appear to have increased vulnerability to be infected with COVID-19 and leads to have a more severe form of disease with worse clinical outcomes (Huang et al., 2020; Wang et al., 2020; Z. Wu & McGoogan, 2020).

A systematic review from China, including 1,527 patients with COVID-19, reported that the prevalence of cardio-cerebrovascular disease (16.4%) was considerably higher than population prevalence and had three times more admissions for severe to critical form of disease (Li et al., 2020).

In another study fatal cases showed a higher rate of comorbidities, including hypertension (48% vs 23%), diabetes (31% vs 14%), and coronary heart disease (24% vs 1%), when compared with survivors respectively (Zhou et al., 2020). Furthermore, Chinese Centre for Disease Control and Prevention reported overall case fatality rate (CFR) of 2.3% among 44,672 confirmed cases of COVID-19, but significantly higher rates of 6%, 7.3% and 10.5% were observed in patients with hypertension, diabetes and CVD respectively (Z. Wu & McGoogan, 2020).

CVD outcomes among COVID-19 cases

A study reported COVID-19–related complications were ARDS (29%), viremia (15%), acute cardiac injury (12%), and secondary infection (10%) (Huang et al., 2020). A review (Bansal, 2020), reported16.7% COVID-19 patients developed arrhythmia, which was 44.4% in severe illness and 8.9% in mild cases. The same review also reported 12% of patients who recovered from COVID-19 developed heart failure. Interestingly, acute coronary event and left ventricular systolic dysfunction were not reported in the studies included in the review.

Systematic review of six published studies from China, including 1,527 patients with COVID-19, reported at least 8% of patients suffered acute cardiac injury, which was about 13 times higher in ICU/severe patients compared with the non-ICU/severe patients (Li et al., 2020). Another review (Bansal, 2020), also reported 8-12% incidence of acute cardiac injury among COVID-19 patients, where acute cardiac injury was defined as elevation of cardiac troponin I above 99th percentile upper reference limit. However, troponin I was also raised with non-cardiac event e.g. systemic inflammation, direct myocardial injury.

SARS-CoV-2 appears to affect the myocardium and cause myocarditis, which is evident from sporadic autopsy cases, suggesting infiltration of myocardium by interstitial mononuclear inflammatory cells (Xu et al., 2020). A study conducted during SARS outbreak reported presence of viral ribonucleic acid in 35% of the autopsied human heart samples, providing evidence of direct myocardial injury by the virus (Oudit et al., 2009). Additionally, studies have been reported of cases with severe myocarditis and reduced systolic

function after COVID-19 (Hu, Ma, Wei, & Fang, 2020; Inciardi et al., 2020). Infection-related myocarditis and/or ischemia is an important prognostic factor in COVID-19.

All the reviews emphasised that it is too early to ascertain potential long-term consequences of CVD for cases suffered from COVID-19 (Bansal, 2020; Driggin et al., 2020; Madjid et al., 2020). It is reasonable to expect that severe and critical cases of COVID-19 have more severe effects on the cardiovascular system due to more robust inflammatory response.

It was also observed, those who were recovering from Severe Acute Respiratory Syndrome (SARS) continued to have long-term abnormalities of lipid (68%) and glucose metabolism (60%), and cardio vascular abnormalities were present in 40% of patients (Q. Wu et al., 2017).

Considering long term impact in careful follow-up of those recovering from the current COVID-19, it will be important to understand the long-term impact of this illness in order to protect these patients from future CVD and its complications.

Effect of quarantine and social distancing on CVD

It is evident from literature that unhealthy diet, lack of exercise, psychosocial stress and insufficient sleep are increasingly prevalent modifiable risk factors for cardiovascular disease (Schloss, Swirski, & Nahrendorf, 2020). Due to the COVID-19 pandemic the world is experiencing an extraordinary, life-altering challenge and many countries have become accustomed to a new normal – “quarantine”, “social distancing” and “shelter in place” are now a part of everyday life (Jimenez-Pavon, Carbonell-Baeza, & Lavie, 2020).

Again, some characteristics of the population have been proven to be at higher risk for COVID-19, such as the elderly, those with hypertension, diabetes or CVD risk factors and CVD, and patients with respiratory diseases or conditions.

The initiation of sudden quarantine and social distancing involves a radical change in the lifestyle of the population, particularly around physical activities. Thus, lack of physical activity and psychosocial stress could contribute to the burden of cardiovascular disease during and following the outbreak. There is no data to estimate how much “quarantine”, “social distancing” and “shelter in place” are contributing to the burden of existing CVD.

Health system, COVID-19 and CVD

One of the reviews (Driggin et al., 2020), regarding CVD health care at the time of the outbreak, recommended:

- provision and expansion of the knowledge and infrastructure for e-visits/telehealth
- triage and patient management through e-visits/telehealth
- improvement of patient and public education regarding indications for quarantine versus hospital presentation
- limiting elective procedures (i.e. echocardiography, cardiac catheterization) if not urgent/emergent.

The American College of Cardiology Clinical Bulletin provides a practical clinical summary about key implications and recommendations for CV care of COVID-19 patients (ACC, 2020). The European Society of Cardiology Council on Hypertension and the European Society of Hypertension statements acknowledge the questions regarding ACEi and ARB therapy in the setting of COVID-19 patients. Current recommendation is that patients with hypertension should receive treatment with ACEi and ARB according to 2018 ESC/ESH guidelines despite COVID-19 infection status and patients with hypertension should continue their home blood pressure medical regimen (ESC, 2020; HC, 2020).

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