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Effects of Covid-19 on Patients with Cardiovascular Diseases: A Systematic Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Review Article

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ABSTRACT

Aim of Object: During the COVID-19 pandemic, the entire world is experiencing a mortality situation; most people are battling against the corona virus, but some individuals have already suffered from cardiovascular problems.

For improved patient care, adequate information and comprehension of the relationship between cardiovascular disorders and COVID-19 is required. The dominant clinical manifestations of the corona virus infection are on the respiratory system. In this instance, the acute cardiac injury is the most often reported cardiac abnormality, in which the degree of cardiac output is increased, troponin levels rise, and mostly it is found in about 8% to 12% of patients. The involvement of viral cardiomyocytes and systemic inflammation is the most prevalent mechanism for cardiac damage. The corona virus attaches itself and enters through angiotensin converting enzyme-II.

Discussion and Conclusion: Recent articles on COVID-19 have revealed nothing regarding these

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individuals' cardiac vascular manifestations. This is a critical component of all that has a big influence on COVID-19 patients' cardiovascular systems. To fully comprehend the method and effects, more study is required.

Keywords: COVID-19; cardiovascular disease; cardiac troponins; angiotensin converting enzyme-II (ACE-II).

1. INTRODUCTION

Corona viruses are a wide group of viruses that may infect both animals and humans. Several corona viruses have been linked to respiratory infections in humans, ranging from the common cold to more serious illnesses including Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). This pandemic is challenging task for everyone especially healthcare sector around the world. Symptomatic phase of this virus is very dangerous but even in asymptomatic phase of Covid-19 has the ability to infect others and transmit in community at high infective rate which make the Covid -19 a world pandemic. Before the outbreak in Wuhan, China, in December 2019, no one had heard of this new virus or illness [1,2,3].

The signs and symptoms might be range from a simple case of the flu to worst cases of pneumonia. When corona infected individuals have non-communicable conditions such as cardiovascular disease or diabetes, these symptoms become much worse. If individuals are already having cardiovascular disease then they are more vulnerable to COVID 19 and worsen condition in the cardiovascular disease. The primary goal of this study is to offer an overview of various cardiovascular diseases and their manifestations in COVID 19 patients, as well as the influence of COVID 19 on patients with cardiovascular illness before and after treatment. Since scientists are continuously working to understand the new symptoms of COVID-19 [4].

1.1 Pathogenic Considerations

The seven species of SARS CoV-2 (RNA beta corona virus) produce infection in humans and 4 species mainly produce flu like syndrome but the other 3 species (SARS, MERS and COVID-19) cause severe illness in humans. SARS CoV-2 primarily attack in the respiratory system but cardio vascular system also affected in several ways [5].

Angiotensin-converting enzyme (ACE-2) is a key player in the neurohumoral control of the cardiovascular system, both in good health and in disease. SARS CoV-2 binds to ACE-2 receptors in the lungs and heart, altering the ACE-2 signalling pathway and causing pulmonary and cardiac issues [6]. COVID-19 causes systemic inflammation and increase the level of cytokines which leads to multiple organ failure. In studies, it has cleared that severe COVID-19 illness has high level of cytokines [7]. Acute respiratory illness reduce the oxygen demand supply which cause acute myocardial injury [8].

Systemic inflammation can create prothrombotic milieu and worsen the symptoms. Precipitation of plaque ruptures by systemic inflammation and increased shear stress due to increase coronary blood supply cause the acute myocardial infarction [9]. COVID 19 is treated with a variety of antiviral medications, corticosteroids, and other treatments, although these have negative effects on the cardiovascular system. Electrolyte imbalance is common in cardio vascular disease patients and it can occur in any systemic condition, causing arrhythmias [10]. Hypokalemia increases susceptibility to injury to various tachyarrhythmias [11].

1.2 Cardiovascular Complications

Chaolin huang et al (2020) were reported that the COVID-19 cause myocardial injury and myocarditis with increases in troponin level which is due to hypoxia, Increased cardiac physiologic stress or direct myocardial injury, they were taken 41 patients and found 12% acute cardiac injury [12]. Chen Chen and Dao Wen Wang (2020) were reported that myocarditis also recognizes with increase viral loads and related casualties [13]. Zhe Xu et al (2020) were found that acute Myocardial infarction (AMI) and atherosclerotic plaque disruption increases in systemic inflammation [14].

Fei Zhou et al (2020) have been proved in patients with an initial stage of corona virus infection that 23% of AHF patients and 33% of cardiomyopathy patients were found among the COVID-19 positive cases [15]. In another study Inciardi RM et al (2020) discovered that heart

failure was present in 24% of corona patients, and that it was associated to a higher risk of mortality during COVID-19 [16].

Olejniczak M, et al in 2020 have found that patients infected with COVID 19 are also in risk of getting Venous Thromboembolic event (VTE) [17]. Driggin E et al have mentioned various factors which contribute in developing VTEs are systemic inflammation, coagulation abnormality, multi organ dysfunction [18]. In 2020 Clerkin KJ has reported in one study and suggests that there is abnormality in coagulation pathway in COVID 19 patients with increased level of D-dimer [19] Xiong TY and Inciardi RM in 2020 described If the level of D-dimer was found to be greater than 1mcg/mL, then it may be the major reason behind the mortality in COVID 19 patients [20,21].

Inciardi RM and Lupi L studied and described (2020) that myopericarditis as an etiology for Cardiovascular collapse- The SARS CoV 2 can cause myocarditis and pericarditis that sometime may or may not be associated with pneumonia [22]. Olejniczak M said myocarditis may be identified using specialist imaging using Cardiac magnetic resonance and contrast enhancement, which is caused by events such as necrosis, scarring, and myocardial edoema [23]. Friedrich MG et al in 2020 reported that the focal or global Myocardial inflammation are the results of myocarditis**.** Focal myocarditis can mimic an acute coronary syndrome, or may present with acute chest pain or angina and can result in coronary angiography emergency [24].

Libby P and Simon D have mentioned in 2020 that right ventricular failure as a cause of cardiovascular collapse- Patients with severe COVID 19 are at a significant risk of developing adult respiratory distress syndrome. COVID 19 patients have a higher risk of developing deep venous thrombosis and acute pulmonary embolism. In individuals with severe COVID 19, factors that may compromise right ventricular function include vasoplegic shock myocarditis and acute coronary syndrome [25].

1.3 Medication Interactions

Newly medications interact broadly with other CV drugs including anticoagulants, antiplatelet and statin. In the treatment of COVID-19, many of agents may have interaction [26]. They show interaction with oral antiplatelet drugs. Protease inhibitor like Lopinavir and Rotinavir inhibit CYP3A4 metabolism. Interaction with clopidogrel, reduction in clopidogrel active metabolite, prasugrel, decreased active metabolite, ticagrelor, increased effects of ticagrelor, cilostazol, recommend decreasing dose to maximum of 50 mg twice a day [27,28].

Remdesivir is the nucleotide-analog inhibitor of RNA-dependent RNA polymerases, it interacts with clopidogrel, prasugrel, ticagrelor and cilostazol induce CYP3A4 and no dose adjustment recommended [29,30].

Tocilizumab inhibits IL-6 receptor and it may potentially mitigate cytokine release syndrome symptoms in severely ill patients and interact with clopidogrel, reported increase in expression of 2C19 in the major manner and 1A2, 2B6, and 3A4 in minor manner but there is no dose adjustment recommended, prasugrel, reported increase in expression of 3A4 in major way and 2C9 and 2C19 in minor way, but there is no dose adjustment recommended, ticagrelor and cilostazol, reported increase in expression of 3A4 in major way, but there is no dose adjustment recommended [31,32].

Sarilumab binds with IL-6Rs (sIL-6Rα and mIL-6Rα), inhibit IL-6-mediated signaling which may potentially mitigate cytokine release syndrome symptoms in severely ill patients. It interacts with clopidogrel, shows minor pathways of increase in expression of 3A4, no dose adjustment recommended, prasugrel and cilostazol shows major pathways of increase in expression of 3A4, no dose adjustment recommended, ticagrelor shows major pathways of increase in expression of CYP3A4, no dose adjustment recommended [33].

Lopinavir/ritonavir interacts with some anticoagulant such as vitamin K Antagonists induce CYP2C9 and may decrease plasma concentration. Dabigatran inhibit P-gp and may increase plasma concentration. Apixaban shows CYP3A4 and P-gp inhibition, administer at 50% of dose. Betrixaban shows P-gp and ABCB1 inhibition, decrease dose to 80 mg once followed by 40 mg once daily. Edoxaban inhibit P-gp, do not co-administer. Rivaroxaban inhibit CYP3A4 and P-gp inhibition, do not co-administer [34].

Tocilizumab interacts with some anticoagulant such as betrixaban, increase in expression of 3A4 by major pathway, in that case no dose adjustment recommended. Rivaroxaban increases in expression of 3A4 by major pathway

and no dose adjustment recommended. Sarilumab interacts with apixaban and rivaroxaban, increase in expression of CYP3A4 by major pathway and no dose adjustment recommended [35].

2. DISCUSSION

Cardiovascular patients are particularly vulnerable in the event of a COVID-19 pandemic, as SARS CoV-2 may exacerbate their condition. Some drugs are used to treat this illness; however studies have shown that these treatments can have negative impacts on the health of individuals who are already suffering from cardiovascular disease. Some of the drugs like anticoagulant and antiplatelets, show interaction with the antiviral drugs at the different level of pharmacokinetic parameters. Remdesivir, Tocilizumab and Sarilumab interact at the biotransformation level with the drugs, useful for cardiovascular disease, needful for dose adjustment but sometime there is no need to dose adjustment.

3. CONCLUSION

COVID-19 infection is associated with the cardiovascular disease like myocardial injury and myocarditis, VTE, AMI, Heart failure. Medications that are used to treat COVID 19 also have potential adverse effects on heart and circulatory system. When treating COVID 19 patients, it is essential for persons with cardiovascular disease to be informed of the contraindications of medications, as well as for clinicians to be aware of these side effects or consequences.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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