

## Review Article

# Cardiovascular Manifestations of Covid-19: A Review

**Qianlan Xi<sup>1</sup>, Muhammad Adnan Haider<sup>2</sup>, Muhammad Hanif<sup>3\*</sup>, Mukarram Jamat Ali<sup>4</sup>,  
Muhammad Umer Ahmed<sup>5</sup>, Muhammad Aslam Khan<sup>2</sup>, Sundas<sup>3</sup>, Amin H Karim<sup>6</sup>**

<sup>1</sup>Department of Internal Medicine, West China Hospital, Sichuan University, Chengdu, China

<sup>2</sup>Department of Internal Medicine, Allama Iqbal Medical College, Lahore, Pakistan

<sup>3</sup>Department of Internal Medicine, Khyber Medical College Peshawar, Peshawar, Pakistan

<sup>4</sup>Department of Internal Medicine, King Edward Medical University Lahore, Pakistan

<sup>5</sup>Department of Internal Medicine, Ziauddin University and hospital, Ziauddin Medical College, Karachi, Pakistan

<sup>6</sup>Associate Professor of Cardiology, Baylor College of Medicine, Texas, United States

**\*Corresponding author:** Muhammad Hanif, Department of Internal Medicine, Khyber Medical College Peshawar, Hayatabad Medical Complex, Peshawar, Pakistan, E-mail: [hanifafridi273@gmail.com](mailto:hanifafridi273@gmail.com)

**Received:** 10 May 2020; **Accepted:** 22 May 2020; **Published:** 4 June 2020

**Citation:** Qianlan Xi, Muhammad Adnan Haider, Muhammad Hanif, Mukarram Jamat Ali, Muhammad Umer Ahmed, Muhammad Aslam Khan, Sundas, Amin H Karim. Cardiovascular Manifestations of Covid-19: A Review. Archives of Internal Medicine Research 3 (2020): 131-135.

## Abstract

The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has become a global pandemic. After reviewing recent publications on clinical manifestations of COVID-19, we have found that in addition to respiratory, gastrointestinal and neurological symptoms, cardiovascular manifestations including myocardial injury, heart failure, arrhythmias and venous thromboembolism are also common in patients with COVID-19, especially in those with severe disease. It is very important to identify cardiovascular manifestations

at early stage of the disease and appropriate interventions should be considered for these patients for a better outcome.

**Keywords:** COVID-19; SARS-Cov-2; Myocardial Infarction; Arrhythmias; Heart Failure; Venous Thromboembolism

## 1. Introduction

The coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2

(SARS-CoV-2) has become a pandemic throughout the world after its origin from Wuhan, China. Pneumonia characterized primarily by fever, cough, dyspnea, and bilateral infiltrates on chest imaging appears to be the most frequent manifestation of infection [1-4]. Additionally, gastrointestinal symptoms (eg, nausea and diarrhea), anosmia and dysgeusia have also been reported [5, 6]. Moreover, many patients with COVID-19 have been reported to present with symptoms of cardiovascular disease. There is a need of the hour to diagnose these manifestations at earliest to limit long term sequelae. We present the spectrum of common cardiovascular manifestations of patients with COVID-19.

## 2. Myocardial Injury

Numerous studies have reported acute myocardial injury including both ischemic myocardial injury and non-ischemic myocardial injury as an important manifestation of COVID-19, even without symptoms and signs of interstitial pneumonia [7-12]. The proposed mechanisms of myocardial injury are direct damage to the cardiomyocytes, systemic inflammation, myocardial interstitial fibrosis, interferon mediated immune response, exaggerated cytokine response by Type 1 and 2 helper T cells, in addition to coronary plaque destabilization and hypoxia [13]. The frequency of myocardial injury (reflected by elevation in cardiac troponin levels) varies from 7 to 28 percent among hospitalized patients with COVID-19 [7-10]. It has also been reported that in hospitalized patients with more severe disease and worse outcomes, the frequency and magnitude of troponin elevations are much higher. Shi S, et al. conducted a cohort study including 416 hospitalized patients with COVID-19 in Wuhan, China and found that a total of 82 patients (19.7%) had cardiac injury. Patients with cardiac injury had higher mortality

than those without cardiac injury (51.2% vs 4.5%) [10]. In a Cox regression model, patients with versus those without cardiac injury were at a higher risk of death, both during the time from symptom onset (hazard ratio, 4.26 [95% CI, 1.92-9.49]) and from admission to end point (hazard ratio, 3.41 [95% CI, 1.62-7.16]). In another retrospective multicenter cohort study Zhou F, et al. reported that myocardial injury was identified on admission in 46 percent of non-survivors versus 1 percent of survivors [11]. A small series of 21 critically ill patients with COVID-19 in Washington State, cardiomyopathy developed in 7 patients (33%) [14]. It is also noticed that patients with elevated troponin levels were older than patients with normal troponin level ( $71.4 \pm 9.4$  vs  $53.5 \pm 13.2$  years) [15].

## 3. Heart Failure

Heart failure in patients with pre-existing known or undiagnosed heart diseases (for example, coronary artery disease or hypertensive heart disease) or incident acute myocardial injury (for example, stress, cytokine storm, systemic hyperinflammatory response, etc.) may be precipitated by acute COVID-19 [16]. Zhou F, et al. found that heart failure was identified in 52% non-survivors and in 12% survivors [11]. Similarly, in a retrospective study of 799 patients hospitalized with COVID-19 in Wuhan, China, Chen T, et al. demonstrated that 49% non-survivors had heart failure, while only 3% survivors had heart failure [17]. In another study conducted by Shi S, et al. N-terminal proBNP (NT-proBNP) levels were significantly higher in patients with heart injury than in patients without heart injury [10]. Moreover, patients with a known history of heart failure may also suffer an acute decompensation due to the development of COVID-19 disease. [18]

#### 4. Arrhythmias

Arrhythmias as manifestations in patients with COVID-19 have been reported in several published articles. Arrhythmias could be the first presentation of COVID-19 and new-onset and/or progressive arrhythmias could indicate cardiac involvement. Guo T, et al. found that patients with elevated TnT levels had more frequent malignant arrhythmias. [15] Liu K, et al. conducted a study, including 137 patients in Wuhan, China showed that 7.3% of the patients had experienced palpitations as one of their presenting symptoms of COVID-19 [19]. Arrhythmias were found to be more common in intensive unit (ICU) COVID-19 patients than in non-ICU COVID-19 patients according to Wang D, et al. [20]. However, in these two reports, the cause of palpitations or type of arrhythmia was not specified. While Guo T, et al. found that there is a higher incidence of malignant arrhythmia (hemodynamically unstable ventricular tachycardia or ventricular fibrillation) in patients with elevated troponin T than patients without (11.5% vs. 5.2%) [15].

#### 5. Venous Thromboembolism

There were 22.7% cases of deep venous thrombosis (DVT) in patients with COVID-19 reported by Shi Z, et al. [21] from China. This might be due to higher level of D-dimer, fibrin degradation products (FDP) and fibrinogen in patients with COVID-19 as compared to healthy controls [22] and similarly higher levels of these coagulation markers were seen in patients with severe COVID-19 than those with mild COVID-19 based on a meta-analysis [23]. Zhou F, et al. found that d-dimer greater than 1µg/mL was associated with increased odds of in-hospital death [11]. Case series of ICU patients have reported high rates (20 to 43 %) of venous thromboembolism (VTE) [mostly pulmonary embolism (PE)] despite prophylactic anticoagulation. While the

cumulative incidence of VTE calculated by Klok FA, et al. was 27% [24] whereas it was 39% in another study including 74 ICU patients with COVID-19 by Middeldrop S, et al. [25]. Thus, VTE (including pulmonary embolism) should be considered in the setting of critically ill patients with COVID-19.

#### 6. Conclusion

Cardiovascular manifestations, including myocardial injury, heart failure, arrhythmias and venous thromboembolism are of great concern in patients with COVID-19. These tend to be more common in patients with severe COVID-19 and are associated with increased mortality. Physician should be aware of these cardiovascular manifestations even in the absent of common respiratory presentations of COVID-19 to identify them earlier to limit the worst outcomes associated, including death. We recommend having a low threshold for the identification of such manifestations especially in patients with preexisting co-morbidities for example hypertension, diabetes and cardiac abnormalities.

#### Conflict of Interest

Authors declare no conflict of interest.

#### Funding

No funding, from any sources have been received in writing of this manuscript.

#### Discussion

The common cardiovascular manifestations of COVID-19 are discussed below.

#### References

1. Ozma MA, Maroufi P, Khodadadi E, et al. Clinical manifestation, diagnosis, prevention and control of

- SARS-CoV-2 (COVID-19) during the outbreak period. *Infez Med*. Ahead of print 28 (2020): 153-165.
2. 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* 395 (2020): 507.
  3. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 395 (2020): 497-506.
  4. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA* (2020).
  5. Jin X, Lian JS, Hu JH, et al. Epidemiological, clinical and virological characteristics of 74 cases of coronavirus-infected disease 2019 (COVID-19) with gastrointestinal symptoms. *Gut* (2020).
  6. Giacomelli A, Pezzati L, Conti F, et al. Self-reported olfactory and taste disorders in SARS-CoV-2 patients: a cross-sectional study. *Clin Infect Dis* (2020).
  7. Lippi G, Lavie CJ, Sanchis-Gomar F. Cardiac troponin I in patients with coronavirus disease 2019 (COVID-19): Evidence from a meta-analysis. *Prog Cardiovasc Dis* (2020).
  8. Clerkin KJ, Fried JA, Raikhelkar J, et al. Coronavirus Disease 2019 (COVID-19) and Cardiovascular Disease. *Circulation* (2020).
  9. Bhatraju PK, Ghassemieh BJ, Nichols M, et al. Covid-19 in Critically Ill Patients in the Seattle Region - Case Series. *N Engl J Med* (2020).
  10. Shi S, Qin M, Shen B, et al. Association of Cardiac Injury With Mortality in Hospitalized Patients With COVID-19 in Wuhan, China. *JAMA Cardiol* (2020).
  11. Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 395 (2020): 1054-1062.
  12. nciardi RM, Lupi L, Zaccone G, et al. Cardiac Involvement in a Patient With Coronavirus Disease 2019 (COVID-19). *JAMA Cardiol* (2020).
  13. Babapoor-Farrokhman S, Gill D, Walker J, et al. Myocardial injury and COVID-19: Possible mechanisms. *Life Sci* 253 (2020): 117723.
  14. Arentz M, Yim E, Klaff L, et al. Characteristics and Outcomes of 21 Critically Ill Patients With COVID-19 in Washington State. Characteristics and Outcomes of 21 Critically Ill Patients With COVID-19 in Washington State. *JAMA* (2020).
  15. Guo T, Fan Y, Chen M, et al. Cardiovascular implications of fatal outcomes of patients with coronavirus disease 2019 (COVID-19). *JAMA Cardiol* (2020).
  16. Atri D, Siddiqi HK, Lang J, et al. COVID-19 for the Cardiologist: A Current Review of the Virology, Clinical Epidemiology, Cardiac and Other Clinical Manifestations and Potential Therapeutic Strategies. *JACC Basic Transl Sci* (2020).
  17. Chen T, Wu D, Chen H, et al. Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study. *BMJ* 368 (2020): m1091.
  18. Fried JA, Ramasubbu K, Bhatt R, et al. The Variety of Cardiovascular Presentations of COVID-19. *Circulation* (2020).
  19. Liu K, Fang YY, Deng Y, et al. Clinical characteristics of novel coronavirus cases in tertiary hospitals in Hubei Province. *Chin Med J (Engl)* 133 (2020): 1025-1031.

20. Wang D, Hu B, Hu C, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA* (2020).
21. Shi Z, Fu W. Diagnosis and treatment recommendation for novel coronavirus pneumonia related isolated distal deep vein thrombosis. *Shanghai Medical Journal* (2020).
22. Han H, Yang L, Liu R. Prominent changes in blood coagulation of patients with SARS-CoV-2 infection. *Clin Chem Lab Med* (2020).
23. Xiong M, Liang X, Wei YD. Changes in Blood Coagulation in Patients with Severe Coronavirus Disease 2019 (COVID-19): a Meta-Analysis. *Br J Haematol* (2020).
24. Klok FA, Kruip MJHA, van der Meer NJM, et al. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. *Thromb Res* (2020).
25. Middeldorp S, Coppens M, van Haaps TF, et al. Incidence of venous thromboembolism in hospitalized patients with COVID-19. *J ThrombHaemost* (2020).



This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC-BY\) license 4.0](https://creativecommons.org/licenses/by/4.0/)