THE FREQUENCY OF CARDIOVASCULAR COMPLICATIONS IN PATIENTS SUFFERING FROM COVID-19

Muhammad Zahid Ali Raza[a], Irfan Younus Bhatti Rajput[a*], Kashif Zafar[b], Faiza Altaf[c], Sobia Aziz[a]

[a]Nawaz Sharif Medical College, Gujrat. [b]Punjab Institute of Cardiology, Lahore, Pakistan. [c]General Practitioners

ABSTRACT:

BACKGROUND: Pandemic caused by Corona virus infection has damaged the population throughout the universe. Cases of COVID-19 increased rapidly in whole world. COVID-19 has been associated with a number of cardiovascular co-morbidities including hypertension, ischemic heart disease, diabetes mellitus, dyslipidemia, atrial fibrillation and cardiac failure.

AIMS & OBJECTIVE: To determine the frequency of cardiovascular complications in patients with COVID-19.

MATERIAL & METHODS: This observational cohort study was conducted in corona ward of DHQ Hospital, Gujrat from 1st January to 31st June 2021. Total 216 patients between 18-70 years of age, admitted who had COVID-19 confirmed by PCR after taking informed consent; patients already suffering from any cardiovascular, respiratory or other life threatening illness were excluded while hypertensive, diabetics and smoker were included in the study. Duration of admission was according to the severity of illness. Detailed history was taken from all patients followed by relevant examination. Investigations like ECG, echocardiographically and troponins were done to diagnose cardiovascular complications. All the patients were treated conservatively. Frequency of cardiovascular complications was noted. The patients who had clinical relief of symptoms, fever free, normal X-Ray chest and at least two consecutive negative PCR results for covid-19 were discharged. p value <0.05 was considered as significant.

RESULTS: Out of two hundred sixteen patients, 30(14%) patients were diabetics and 21(10%) were hypertensive. Myocardial injury in 12% (myocarditis 4%, myocardial infarction 1%, raised troponins without myocarditis and ECG changes in 7% thromboembolism 1%, right ventricle dysfunction 5%, arrhythmias in 9%. Most of the patients had mild symptoms and recovered by conservative management. About 4-5% patients required invasive ventilatory support. Age, gender, diabetes, hypertension and previous cardiovascular co-morbidities increase the frequency of cardiovascular complications. The mortality of myocarditis was around 2% and overall mortality was 5%. p value was calculated as significant < 0.05.

CONCLUSION: COVID-19 is known for cardiovascular complications in which acute myocardial injury, myocarditis, arrhythmias, thromboembolism, right ventricle dysfunction are common. These complications are more common in those having cardiovascular disease (CVD) or other co-morbidities.

KEY WORDS: COVID-19, cardiovascular complications, acute myocardial injury, myocarditis, arrhythmias.

Correspondence : Irfan Younus Bhatti Rajput, Nawaz Sharif Medical College, Gujrat, Pakistan.
Email: irfanyounis7887@gmail.com

Author's Contribution: MZAR: Data collection, study design, concept. IYBR: Data analysis. KZ: Data collection, FA: Literature search. SA: Questionair design.

INTRODUCTION:

Pandemic caused by Corona virus infection has damaged the population throughout the universe. Cases of COVID-19 are increasing rapidly in whole world. It was observed in previous studies that COVID-19 can lead to rapid detoriation in patients already having chronic illness.[1-4]. COVID-19 has been associated with a number of cardiovascular co-morbidities including hypertension, ischemic heart disease, diabetes mellitus, dyslipidemia, atrial fibrillation and cardiac failure[5]. Studies have shown that more than 40% of COVID-19 patients presented with any cardiovascular disease.[6] COVID-19 patients with known cardiovascular disease have increased mortality, thromboembolism, septic shock and more need for invasive respiratory support as compared to those without cardiovascular disease.[7] Overall mortality of COVID-19 infection was around 2%[8].

Hypertension is associated with severity of COVID-19 patients[9]. Acute cardiovascular complication of COVID-19 includes chest pain, raised troponins, myocarditis, myocardial infarction, left ventricular or right ventricular dysfunctions, arrhythmias, thromboembolism[10] According to a study by Huang et al[11], acute myocardial injury was found in 12% of patients with COVID-19. Another study on 138 patients with COVID-19 concluded that 16% of patients had arrhythmias and myocardial injury in 7.2% cases[12]. Myocarditis can be diagnosed clinically and echocardiographicaly. In previous studies it was found that COVID-19 can lead to myocarditis[13] that's why many patients suffer from myocarditis after COVID-19[14]. Myocarditis is a cardiac emergency which lead to hypotension and cardiac shock resulting in upto 50-70%[15] mortality. Echocardiography is an important test to diagnose myocarditis and left ventricular dysfunction.[16]

Acute myocardial injury includes acute coronary syndrome, stress cardiomyopathy and myocarditis having poor prognosis. Studies show that the pathophysiology of myocardial infarction in COVID-19 patients is different from conventional coronary artery or plaque rupture[17]. Thromboembolism includes intra-cardiac thrombus, pulmonary embolism, DVT, stroke. The prevalence of arrhythmias varies from 17-29%[18] which includes atrial fibrillation, ventricular arrhythmias, conduction blocks. The cardiovascular complications are diagnosed clinically, by blood testing, ECG, echocardiography.

MATERIAL AND METHODS:

This was a prospective observational study which was done on 216 patients between 18-70 years of age, admitted in corona observational of DHQ Hospital, Gujrat from 1st January to 31st June 2021. It was conducted on the patients who had COVID-19 confirmed by PCR after taking informed consent; patients already suffering from any cardiovascular, respiratory or other life threatening illness were excluded while hypertensive, diabetics and smokers were included in the study. Duration of admission was according to the severity of illness. All patients remained admitted till recovery or fatal outcome. Detailed history was taken from all patients followed by relevant examination. Investigations like ECG, echocardiographically and troponins were done to diagnose cardiovascular complications. Frequency of cardiovascular outcomes and in-hospital mortality were noted. The patients who had clinical relief of symptoms, fever free, normal X-Ray chest and at least two consecutive negative PCR results for covid-19 were discharged. Mean and standard deviation were calculated for quantitative variables like age. While qualitative variables like gender, hypertension, smoking, diabetes Mellitus, myocardial injury, myocarditis, heart failure, arrhythmias and thromboembolism frequency and percentages were calculated. To control the effect modifier stratification was done. After stratification Chi square test was used to analyze the effects on the outcomes. Data was entered and analyzed with SPSS -22 and p value <0.05 was taken as significant.

RESULTS:

Out of two hundred sixteen patients, 30(14%) patients were diabetics and 21(10%) were hypertensive. Myocardial injury in 12% (myocarditis 4%, myocardial infarction 1%, raised troponins without myocarditis and ECG changes in 7%) thromboembolism 1%, right ventricle dysfunction 5%, arrhythmias in 9%. Most of the patients had mild symptoms and recovered by conservative

Table 1: Clinical features of 216 patients included in the study

		N (%)
Age		37±10
Gender	Male	152 (70%)
	Female	64 (30%)
Hypertension	Present	40 (18%)
Diabetes	Present	30 (14%)
Smoking	Present	51 (24%)
Obesity	Present	47 (21%)

Table 2   Correlation of cardiovascular complication with co-morbidities

CVS Complications	DM	Without DM	HTN	Without HTN	Smoker	Non smoker	Prior CVS disease	without CVS disease	mortality
Non-Ischemic myocardial injury %	11 (5%)	4 (2%)	13 (6%)	2 (1%)	9 (4%)	5 (3%)	13 (6%)	2 (1%)	0
Myocarditis %	5 (3%)	2 (1%)	5 (3%)	2 (1%)	5 (3%)	2 (1%)	5 (3%)	2 (1%)	4 (2%)
Acute coronary syndrome (STEMI/ NSTEMI) %	2 (1%)	0	2 (1%)	0	2 (1%)	0	2 (1%)	0	2 (1%)
Arrhythmias %	15 (7%)	4 (2%)	13 (6%)	5 (3%)	13 (6%)	5 (3%)	15 (7%)	4 (2%)	2 (1%)
Thromboembolism (Stroke & DVT) %	2 (1%)	0	2 (1%)	0	2 (1%)	0	2 (1%)	0	0
Right ventricular failure%	9 (4%)	2 (1%)	5 (3%)	4 (2%)	9 (4%)	2 (1%)	9 (4%)	2 (1%)	2 (1%)

management. About 4-5% patients required invasive ventilatory support. Age, gender, diabetes, hypertension and previous cardiovascular co-morbidities increase the frequency of cardiovascular complications. Overall mortality was around 5%. p value was considered as significant < 0.05.

DISCUSSION:

This study showed different risk factors and types of cardiovascular complications in COVID-19 patients. COVID-19 is known for cardiovascular and respiratory complications. These complications were more prevalent in diabetics, hypertensive, smokers and prior cardiovascular diseased patients. Diabetes was associated with bad prognosis and high mortality in patients with COVID-19 as well as hypertension had a strong effect on cardiovascular outcome and survival9. Similarly, CVD complications were more commonly seen in smokers that correlate with prior studies. Patients with COVID-19 with cardiovascular co-morbidities have higher mortalities[19]. Our study also proved this finding. Severity of COVID-19 correlates with cardiovascular complications[20].

Patients with prior cardiovascular disease have more cardiac injury as compared to without CVD (54% vs 13%)[8] In-hospital mortality was 7.6% for patients without CVD and normal troponins, 13% for those with CVD and raised troponins, 37% without CVD and raised troponins 69% for those with CVD and raised troponins[8]. Our study also proved that myocardial injury and troponins elevation were commonly observed in prior cardiovascular disease patients.

In our study myocarditis was seen in 4% of patients and overall mortality due to myocarditis was 2%. Myocarditis was noted more frequently in diabetics, hypertensive, smokers and co-morbid cardiovascular patients. Study by Faber et al, showed that myocarditis resulted in sudden cardiac death in 8.6% of patients and it is found in 9 % of routine postpartum examination[21]. Our results were similar to Peiris JS and colleagues in which patients with COVID-19 had 0.2-2% incidence of myocarditis[22]. Patients with myocarditis developed cardiogenic shock which was managed conservatively. These patients developed more

arrhythmic complications as well. Overall prognosis due to myocarditis could be improved if we do have mechanical circulatory support.

Arrhythmic complications were noted in 9% of patients. Common arrhythmias were atrial fibrillation, supraventricular tachycardia, heart blocks, ventricular tachycardia. Arrhythmic complications were more common in diabetics, hypertensive, smokers and co-morbid cardiovascular patients. Mortality due to arrhythmias was 1%. Arrhythmias were managed according to guidelines conservatively. Reversible causes like electrolyte imbalance were managed. In a previous study incidence of arrhythmias noted was 16%[26] and later on another study showed incidence 5.9%[23].

Acute coronary syndrome was note in 2% of patients which included STEMI & NSTEMI with overall mortality was 1% due to acute ischemic insult. These patients were managed conservatively by anti- ischemic treatment as there was no invasive cardiac setup was available to manage the COVID-19 patients for primary interventions. Mortality could be reduced if we do have dedicated cardiac cath available. ACS complications were more commonly seen in diabetics, hypertensive, smokers and prior cardiovascular disease patients. In previous study acute MI was cause of death in two of five fatal cases[24].

Thromboembolic complications including DVT, arterial thrombosis, pulmonary embolism were noted in 5% of patients which were more common in diabetics, hypertensive, smokers and prior cardiovascular disease patients. Overall mortality due to thromboemblic complication was 1%. Mechanism can be hypercoagubility or endothelial dysfunction. In previous study the prevalence of DVT in COVID-19 was 22% and in ICU patients 27%[25]. Another study reported 7.7% incidence of thromboembolism in COVID-19 patients30 and pulmonary embolism is most common thrombotic event[26].

Our study also showed that COVID-19 patients may develop cardiogenic shock due to acute left or right ventricle failure. Myocarditis is common to cause cardiac failure and shock and these complications are more common in smokers, diabetics and patients with hypertension or prior cardiovascular disease. In Previous study, cardiac complications like heart failure and myocarditis resulting in shock was seen in COVID-19 patients[27]. Mortality could have been further reduce if we do have multidisciplinary fully equipped hospital and dedicated team of medical personale.

CONCLUSION:

Viruses like COVID-19 are known to cause cardiovascular and other complications. Our study described the frequency and association of cardiaovascular complications with risk factors and co-morbid conditions. CVS complications are more common in patients with hypertension, diabetes, smoking and prior cardiovascular disease. Multidisciplinary approach, invasive cardiac centre and dedicated team is required to deal with these complications to decrease the morbidity and mortality.

References:

1. Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan, China: the mystery and the miracle. J Med Virol. 2020;92(4):401-402. doi:10.1002/jmv.25678

2. Hui DS, I Azhar E, Madani TA, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health: the latest 2019 novel coronavirus outbreak in Wuhan, China. Int J InfectDis.2020;91:264-266. doi:10.1016/j.ijid. 2020.01.009

3. Paules CI, Marston HD, Fauci AS. Coronavirus infections: more than just the common cold. JAMA. Published online January 23, 2020. doi:10.1001/jama. 2020.0757

4. Wuhan Municipal Health Commission. Report of clustering pneumonia of unknown etiology in Wuhan City. Published December 31, 2019. Accessed January 31, 2020. http://wjw.wuhan.gov. cn/front/web/showDetail/2019123108989

5. Iaccarino G, Grassi G, Borghi C, Ferri C, Salvetti M, Volpe M. Age and Multimorbidity Predict Death Among COVID-19 Patients: Results of the SARS-RAS Study of the Italian Society of Hypertension. Hypertension. 2020;76:366-372.

6. Richardson S, Hirsch JS, Narasimhan M, Crawford MJ, McGinn T, Davidson KW. Presenting Characteristics, Comorbidities, and Outcomes Among 5700 Patients Hospitalized With COVID-19 in the New York City Area. JAMA. 2020;323:2052-2059.

7. Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time.Lancet Infect Dis. 2020; 20:533–534. doi: 10.1016/S1473-3099(20)30120-1

8. Wang B, Li R, Lu Z, Huang Y. Does comorbidity increase the risk of patients with COVID-19:

evidence from meta-analysis. Aging. (Albany NY) 2020;12:6049-6057.

9. Lang JP, Wang X, Moura FA, Siddiqi HK, Morrow DA, Bohula EA. A current review of COVID-19 for the cardiovascular specialist. Am Heart J. 2020;226:29-44.

10. Hendren NS, Drazner MH, Bozkurt B, Cooper LT Jr. Description and Proposed Management of the Acute COVID-19 Cardiovascular Syndrome. Circulation. 2020;141:1903-1914.

11. Fried JA, Ramasubbu K, Bhatt R, Topkara VK, Clerkin KJ, Horn E, et al. The Variety of Cardiovascular Presentations of COVID-19. Circulation. 2020;141:1930-1936.

12. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506. doi:10.1016/S0140-6736(20)30183-5

13. Wang D, Hu B, Hu C, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA. Published February 7, 2020. doi:10.1001/jama.2020.158

14. Tao Guo, MD; Yongzhen Fan, MD; Ming Chen, MD et al Cardiovascular Implications of Fatal Outcomes of Patients With Coronavirus Disease 2019 (COVID-19). JAMA Cardiol Published online March 27, 2020 AMA Cardiol. doi:10.1001/jamacardio.2020.1017

15. Edwards S, Small JD, Geratz JD, Alexander LK, Baric RS. An experimental model for myocarditis and congestive heart failure after rabbit coronavirus infection. J Infect Dis. 1992;165(1):134-40. doi:10.1093/infdis/165.1.134.

16. Inciardi RM, Lupi L, Zaccone G, et al. Cardiac involvement 1 with coronavirus 2019 (COVID-19) infection.JAMA Cardiol. 2020. doi:10.1001/jamacardio.2020.1096 67.

17. Hu H, Ma F, Wei X, Fang Y. Coronavirus fulminant myocarditis saved with glucocorticoid and human immunoglobulin. Eur Heart J. 2020: ehaa190. doi:10.1093/eurheartj/ehaa190

18. Shi S, Qin M, Shen B, Cai Y, Liu T, Yang F, et al. Association of Cardiac Injury With Mortality in Hospitalized Patients With COVID-19 in Wuhan, China. JAMA Cardiol.2020;5:802-810.

19. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. JAMA. 2020;323:1061-1069.

20. Position Statement of the ESC Council on Hypertension on ACE-Inhibitors and Angiotensin Receptor Blockers. 13 March 2020. https://www.escardio.org/

21. Fabre A, Sheppard MN. Sudden adult death syndrome and other non ischaemic causes of sudden cardiac death. Heart. 2006 Mar;92(3):316-320. Epub 2005 May 27.

22. Peiris JS, Chu CM, Cheng VC, et al; HKU/UCH SARS Study Group. Clinical progression and viral load in a community outbreak of corona virus associated SARS pneumonia: a rospective study. Lancet. 2003;361(9371):1767-1772. doi:10.1016/ S0140-6736(03)13412-5 27

23. Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, Wang H, Wan J, Wang XLu. Cardiovascular implications of fatal outcomes of patients with coronavirus disease 2019 (COVID-19) [published online March 27, 2020]. JAMA Cardiol. 2020. doi: 10.1001/jamacardio.2020.1017

24. Deng Q, Hu B, Zhang Y, Wang H, Zhou X, Hu W, et al. Suspected myocardial injury in patients with COVID-19: Evidence from front-line clinical observation in Wuhan, China. Int J Cardiol. 2020;311:116-121.

25. Shi Z, Fu W. Diagnosis and treatment recommendation for novel coronavirus pneumonia related isolated distal deep vein thrombosis. Shanghai Medical Journal, 2020. Available: http://kns.cnki.net/kcms/detail/31.1366.R.20200225.1444.004.h

26. Lodigiani C, Iapichino G, Carenzo L, Cecconi M, Ferrazzi P, Sebastian T, Kucher N, Studt J-D, Sacco C, Alexia B. Venous and arterial thromboembolic complications in COVID-19 patients admitted to an academic hospital in Milan, Italy.Thrombosis Res. 2020; 191:9–14.

27. Edwards S, Small JD, Geratz JD, Alexander LK, Baric RS. An experimental model for myocarditis and congestive heart failure after rabbit coronavirus infection. J Infect Dis. 1992;165(1):134-40. doi:10.1093/infdis/165.1.134.