Yoke between COVID-19 infection and cardiovascular diseases: Evidence briefing from Indian studies

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Abstract

Globally, cardiovascular diseases (CVDs) are of major concern. The current pandemic situation of Coronavirus Disease 19 (COVID-19) infection has further hiked the burden of cardiovascular problems. Since India has a large number of cases with cardiovascular problems the interlink between the COVID-19 infection and CVDs has greatly challenged the field of medicine. The interaction between the drugs used in the management of COVID infection and cardiovascular problems is another major area of concern. With the variant nature of the Coronavirus, cases have surged leading to increased mortality and one of the major causes for mortality is cardiovascular complications. This article aims to reflect on the effect of cardiovascular morbidity on COVID-19 infection and the cardiovascular outcome of COVID-19 positive patients in India. The relevant articles for the review were searched using the three databases: CINHAL, Scopus, and PubMed and the search was limited to the studies conducted from January 2020 till May 2021. The review highlighted that Diabetes and Hypertension were the most common comorbidity and were the major contributing factors for the mortality among patients diagnosed with COVID-19 in India.

Keywords: cardiac arrest, cardiovascular disease, COVID-19, coronavirus, coronary artery disease, coronary infarction, SARS-CoV-2.

Introduction

According to the Global Burden of Disease, nearly a quarter (24.8 %) of all deaths in India is due to cardiovascular diseases (CVDs) (Gunnal, Ojha, & Singh, 2021). The most prevalent conditions in India include ischemic heart disease, hypertensive heart disease, and cerebrovascular disease. CVD is now a leading cause of mortality in India and the constant hike in the CVDs will continue to pose a significant economic and social burden on the country (Abdul-Aziz, Desikan, Prabhakaran, & Schroeder, 2019). In this current pandemic situation, curbing the incidences of CVD is going to be a great turning point in reducing the mortality among COVID positives.

India is one among the worst Coronavirus Disease 19 (COVID-19) hit Asian nations claiming the lives of 133738 people who succumbed to death due to the COVID infection by November 2020 (www.mohfw.gov.in). One of the principal causes of mortality in COVID-19 patients is Diabetes Mellitus. Associated cardiovascular problems make them more vulnerable. The Centre for Disease Prevention and Control (CDC) recommends proper therapeutic management and monitoring of blood glucose among diabetics (Goel & Kumar, 2021).

Though COVID-19 infection affects mainly the respiratory system, patients positive for COVID-19 are also presenting with features evocative of cardiac problems such as chest pain and electrocardiographic (ECG) changes. COVID-19 infection can cause myocardial injury and the elevated Troponin may mimic the diagnosis of Acute Coronary Syndrome (ACS). But rapid detection of antibodies for COVID-19 can help triage patients with symptoms of ACS and COVID 19(Bansal, 2020; Mahajan, Negi, Ganju, & Asotra, 2020).

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The surge in COVID-19 cases in India hampered the regular follow-up of individuals with cardiovascular problems resulting in people seeking health care services only when the health condition gets deteriorated and in need of emergency medical aid. The main reason for this declined rate of people seeking healthcare services is due to the unavailability of transportation access and fear of catching COVID-19 in hospitals which is evident with the positive trend in Acute Coronary Syndrome paralleling the pandemic trend (Ramakrishnan et al., 2020). When they come in such a situation to the hospital, in the process of COVID-19 protocol management in the hospital, they become the high-risk group for being tested positive for the COVID-19 infection.

The current pandemic situation has brought few changes in the treatment modality among cardiac patients. Due to the risk of spreading infection from the COVID-19 positive patients during the cardiac intervention procedures; they are treated conservatively with fibrinolytic therapy in the absence of contraindications. If the fibrinolytic checklist does not allow for the patient to go for non-interventional reperfusion therapy, those patients are to be intubated following all standard precautions and then perform the cardiac interventional reperfusion procedures. Coagulation parameters are deranged in COVID-19 patients, which requires diligent care and monitoring of patients during thrombolytic therapy while tracking the bleeding parameters of the patients (Ramakrishnan et al., 2020; Guha et al., 2020).

The findings of electrocardiography of patients with COVID-19 infection may show focal or diffuse ST-segment depression or elevation even without coronary artery disease (CAD). It is possible for supraventricular arrhythmias to develop without CAD. The disease drug interaction is also the reason for the arrhythmias among COVID patients. To mention a few: QT prolongation and Torsades de Pointes (TdP) is a concern among patients treated with hydroxychloroquine and azithromycin as combination drugs for the treatment of COVID infection (Prasad et al., 2020). The other antiviral drugs Lopinavir and Ritonavir also cause QT prolongation and conduction disturbances and can result in myopathy when co-administered with statins. Whereas Ribavirin has variable effects on Warfarin dosing. The diagnosed cardiac patients who are on Tab. Amiodarone needs to be monitored carefully for the QT prolongation since they can develop Amiodarone-induced QT prolongation (Guha et al., 2020).

Globally, several studies are conducted to find out the interaction of COVID-19 and the cardiovascular effects. There is a steady increase in the rate of COVID infection and mortality in India. A study from India found that 78% of COVID-19 patients developed heart diseases, independent of pre-existing conditions (Kaul, 2020). Another review from India reported that around 86% of the fatalities have been reported among those with co-morbidities like diabetes, hypertension, chronic kidney and heart-related issues (Srivastava, 2020). Given these alarming statistics of COVID-19 related cardiovascular problems, this review focuses on the studies conducted in India highlighting the interconnection between cardiovascular issues and the COVID-19.

The search was limited to the studies conducted in the last year (January 2020 till May 2021). The full-text articles of Randomized Controlled Trials, Reviews, Systematic reviews, and the studies conducted among Indians including adult population above 19 years of age were included in this review. In total, 54 studies in PubMed, 37 studies in CINAHL, and 197 studies in Scopus were retrieved in the final search. Out of those nine studies were found to be inclusive of the review as per the inclusion criteria.

The following table outlines the nine Indian studies describing the presenting complaints, comorbidities and the outcome among the COVID-19 confirmed inpatients. (Table 1).

Discussion

The review found that many of the patients diagnosed with COVID-19 in India were known Diabetics and Hypertensives. Some cases developed cardiac complications after being positive for COVID-19 and the mortality was high among patients with comorbidities mainly DM and HTN. The diagnosed cases suffered from a new diagnosis of cardiac muscle

Table 1

Indian Studies Reporting the Presenting Complaints, Comorbidities and the Outcomes among the COVID-19 confirmed.

	Author and Year	The setting of the study	Design	Sample	Study Findings		The outcome of the patients
					Presenting symptoms and baseline investigation findings of the COVID positive patients	Associated Comorbidities	
1	(Pande, Kochhar, Saini, Ganapathy, & Gogia, 2020)	ICU of V.M.M.C and Safdarjung Hospital, India.	Case series	N=27	• Fever (77.7%) • Shortness of breath (70.3%) • Cough (62.9%) • Haemoglobin (<7g/dl) (11.11%) • Lymphocytopenia (7.4%) • Thrombocytopenia and Thrombocytosis (3.7% each) • Elevated serum bilirubin (3.7%) • Elevated liver enzymes (22.2%) • No coagulopathy • Elevated lactate (25.9%) • Elevated creatinine (18.5%) • Chest X-Ray - Bilateral lung infiltrates (88.8%) • Mild, Moderate and Severe Hypoxemia (n=3,8,16 respectively).	• DM (43.7%) • HTN (37.5%) • Both DM and HTN (18.7%).	• Managed with oxygen therapy (37%) • Required ventilator support (62.9%) • Developed Shock and MODS (25.9%) • ICU mortality rate (59.2%).
2	(Kunal, et al., 2020)	Tertiary care hospital, India	Retrospective observational study	N=108	• Fever (75.9%) • Cough (55.6%) • Dyspnea (52.8%) • Chest pain (8.3%) • Sinus tachycardia (0.9%) • First degree AV Block (4.6%) • VT/ VF (1.8%) • Sinus Bradycardia (0.9%) • QT prolongation (17.6%)	• HTN (38%) • DM (32.4%)	The cardiovascular complications reported were: • Acute cardiac injury (25.9%) • Heart failure, Cardiogenic shock, and ACS (3.7% each)
3	(Laxminarayan, et al., 2020)	Andhra Pradesh and Tamil Nadu states, India	Survey including contact tracing and testing.	N=33,584	Not assessed	Comorbidities among the total population are not mentioned in the article.	Among 280 decedents in two Indian states, the most prevalent premorbid conditions were: • DM (53.2%) • Sustained HTN (51.8%) • CAD (13.6%) • Renal disease (10.4%).
4	(Bhandari, et al., 2020)	SMS Medical College and attached hospitals, Jaipur, India	Survey and follow up	N=522	• Fever (55.9%) • Cough (52.75%) • Sore throat (49.6%) • Shortness of breath (46.45%) • Headache (26.77%) • Chest pain (6.29%) • Pain abdomen, fatigue, joint pain, altered sensorium (7.87%).	• HTN (42.46%) • DM (39.72%) • COPD/Bronchial Asthma (16.43%) • CAD (13.69%) • CKD (13.69%) • Valvular Heart Disease (6.84%).	• Mortality (2.87%) • All deceased had multiple comorbid conditions.

Table 1 Cont...
Indian Studies Reporting the Presenting Complaints, Comorbidities and the Outcomes among the COVID-19 confirmed.

Author and Year	The setting of the study	Design	Sample	Study Findings		The outcome of the patients
				Presenting symptoms and baseline investigation findings of the COVID positive patients	Associated Comorbidities	
5 (Majeed, Ajmera, & Goyal, 2020)	Research report with the search using www. covid19india.org.	Retrospective study with descriptive research design.	N=176	• Predominant symptoms- Fever and cough. • Other symptoms-chest tightness, fatigue, and dyspnoea, diarrhoea, myalgia, and anorexia.	• DM (27.8%) • HTN (22.1%) • Both DM & HTN (13%)	**Among the deceased:** • Respiratory problems (13.6%) • Cardiac ailments (6.2%) • DM, HTN & CVD (2.8%) • Kidney ailments (2.27%) • Liver ailments (2.8%).
6 Gupta, et al., 2020	Safdarjung tertiary care hospital, New Delhi, India.	Retrospective observational case series.	N=21	9 patients were symptomatic. Out of them: • Cough and Fever (23.8%) • Sore throat (4.8%) Breathlessness and headache (13.6%).	• HTN (23.8%) • DM (14.2%) • Bilateral consolidation of lower lobes of lungs in Chest X-Ray (4.76%) • Leukopenia (4.76%)	No mortality was reported.
7 (Shukla, Chavali, Mukta, Mapari, & Vyas, 2020)	Tertiary care centre in Pune, Maharashtra, India.	Single-center, retrospective observational study.	N=24	• Cough and tachypnea (100%). • Bilateral (87.5%) and Unilateral (12.5%) pulmonary infiltration in Chest X-Ray.	DM & HTN (37.5%)	• Mortality (16.66%) • Pre-existing HTN (4.16%) • All four have died due to the development of sepsis and multi-organ dysfunction.
8 (Anudeep, Somu, & Kumar, 2020)	Tertiary care hospital, India.	Retrospective observational study.	N=50	• Cough and dyspnoea (84%) • Fever (70%) • New-onset ECG abnormalities (24% with Sinus bradycardia (4%), AVNRT (4%), ST-T changes (8%), PR prolongation (8%).	• DM (64%) • HTN (44%).	• Mortality rate (38%) • Smokers and hypertensives contributed to the higher proportion of nonsurvivors.
9 (Kayina, et al., 2020)	Tertiary care hospital, New Delhi, India.	Prospective observational study.	N=235	• Fever (68.1%) • Cough (59.6%) • Shortness of breath (71.9%) • Gastrointestinal symptoms (12.3%) • Non ST Elevation Myocardial Infarction (0.85%) • Bilateral (80.5%) and unilateral (8.8%) infiltrations in Chest X-Ray. • Acute ischemic stroke (2.13%).	• HTN- (28.1%) • DM- (23.3%) • CKD- (9.5%) • CLD- (4.3%) • Malignancy- (11%).	• Mortality within 24 hours of ICU admission-(8.5%) • Death due to AMI with cardiogenic shock (0.43%). • Death due to refractory hypoxia (9.79%).

Note. DM = Diabetes Mellitus; HTN = Hypertension; MODS = Multiple Organ Dysfunction Syndrome; AV Block = Atrio-Ventricular Block; VT = Ventricular Tachycardia; VF = Ventricular Fibrillation; ACS = Acute Coronary Syndrome; CKD = Chronic Kidney Disease; CVD = Cardiovascular Disease; CLD = Chronic Liver Disease; AMI = Acute Myocardial Infarction.

injury especially myocardial infarction, myocarditis, and cardiogenic shock. Most of the deaths were due to refractory hypoxemia and multiorgan dysfunction syndrome with cardiac complications being one of the indicators for mortality.

The findings of this review are supported by studies conducted in other countries. The results of a meta-analysis of observational studies revealed that the pre-existing cardiovascular comorbidities or risk factors were significantly associated with cardiovascular complications in COVID-19 patients (Sabatino, Rosa, Salvo, & Indolfi, 2020). Another systematic review and meta-analysis revealed that hypertension was the most common pre-existing comorbidity with a frequency of 29.2%, followed by diabetes mellitus (13.5%). The diseased group had higher cardiac and inflammatory biomarkers compared with survivors (Momtazmanes et al., 2020). Yet another systematic review and meta-analysis showed that the relative risk of developing severe COVID-19 or death was significantly higher in patients with risk factors for CVD (HTN and DM) (Bae, Kim, Kim, Shim, & Park, 2021). A retrospective cohort study conducted among hospitalized COVID-19 positive adult patients revealed that DM increased the risk of death from COVID-19 (Rastad, et al., 2020). A study conducted in China revealed that DM and HTN were two of the major risk factors for reaching the composite endpoints among COVID-19 positive patients (Guan et al., 2020).

The review emphasizes on the role of nurses in sensitizing the patients about the risk of cardiovascular diseases linked with COVID infection. This can be an added social responsibility of the nurses which can help prevent the surge in patients getting hospitalized due to COVID related complications and decrease cardiovascular morbidity and mortality.

Conclusion

The COVID-19 pandemic has hit the routine health review process of the patients due to the extended lockdown imposed by the Government. This could be one of the reasons for the increased cardiovascular mortality among COVID infected with known cardiac problems with loss to routine follow-up. Overall,

the findings of the review highlight that there is strong bondage between COVID infection and cardiovascular diseases. This reminds every individual of the importance of self-responsibility and adherence to the preventive measures for fighting COVID infection and thereby contributing to the reduction in cardiovascular-related morbidity and mortality due to COVID infection in the country. It further emphasizes the need for an early health-seeking behaviour among symptomatic patients which can be the cornerstone in the early prevention of morbidity and mortality among patients with or without comorbidities.

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