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Original Research Article

Impact of COVID-19 on cardiovascular diseases: experience at a teaching hospital from rural Telangana

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ABSTRACT

Background: COVID-19 is drastically affecting the health of millions of people globally. Further, the restrictions imposed during lockdowns to curtail the spread of COVID-19 have also shown impact on the economy, psychology and lifestyle of the people. However, little is known about the prevalence and clinical manifestations of COVID-19 in coronary heart diseases in rural India. Hence, the present study aimed to find the effect of COVID-19 and lockdown on the prevalence of coronary heart diseases in rural Telangana.
Methods: The present retrospective study was carried on 1320 medical reports of cardiac inpatients who visited RVM Institute of Medical Sciences and Research Center, Siddipet, Telangana during the period 17th January 2020 to 6th August 2020. The data obtained was analyzed by descriptive statistics using IBM SPSS Statistics version 21.0.
Results: Admission of patients with STEMI (53.6% prelockdown; 26% lockdown period; 36.4% post lockdown) and arrhythmia (7.3% prelockdown; 1.3% post lockdown) decreased while there was a significant increase in hospitalization of myopericarditis patients (1% pre lockdown vs. 10.5% lock down, 9.2% post lockdown) after the initiation of lockdown period. Further, STEMI (mean age 42.07±15.06) and myopericarditis (mean age 30.8±9.02 years) was commonly seen in younger age group patients less than 45 years after the initiation of lockdown period. The mortality rate was 6.6% (n=13) in the total study period of which 57.5% (n=7) deaths were due to myocardial infarction. 63.6% of the cardiac patients tested by RT-PCR were found to be positive for COVID-19.
Conclusions: The prevalence of cardiovascular diseases varied with lockdown periods. Young adults in rural Telangana were also affected by COVID-19 and lockdown.

Keywords: Arrhythmia, Acute cor pulmonale, Acute coronary syndrome, COVID-19, Left ventricular, Left anterior descending artery

INTRODUCTION

The COVID-19 epidemic had an unparalleled impact on people's social, psychological, economic, lifestyle, and health in nearly every country on the planet. COVID-19 was first described as a lung disease characterized by normal influenza-like symptoms and a significant death rate in hospitalized patients. Many other multisystemic manifestations, such as cardiac and cerebrovascular manifestations, have been linked to a higher risk of mortality and ICU hospitalizations in COVID-19 patients in recent investigations.[1] In severe cases of COVID-19, major heart disorders such as acute myocardial damage, myocarditis, arrhythmia, and venous thromboembolism have been observed.[2-5] However, more research into the impact of COVID-19 on cardiovascular illnesses is needed to better understand the disparities in illness and mortality among different races, regions, and ethnicities in the world population. Furthermore, there has been very

little research in India on the influence of COVID-19 on cardiac diseases, particularly in the rural population.

On March 25, 2020, the Indian ministry of health and Family Welfare issued instructions for lockdown I as a means to restrict the spread of COVID-19 in India, which was followed by lockdown II-IV, and concluded on May 31, 2020. The main parameters for each lockdown were changed throughout time and varied between Indian states. During the Telangana lockdown, all vehicular movements were halted except for medical need, and hospitals were told to only admit emergency patients. The country was divided into three zones, red (hotspots), green, and orange, in accordance with the extended rules of May 1, 2020. Vehicle mobility in the green zone was relaxed, and all routine hospital admissions were permitted. Initially, only authorized government hospitals across Telangana were allowed to test and validate by a reverse transcriptase nucleic acid test (RT-PCR) technique for COVID-19. Following the lockdown period, antigen testing for COVID-19 diagnosis was made available to all hospitalized patients in rural, semi-urban, and public health settings.[6] Previous studies have found that the lockdown increases the risk of cardiovascular disease by altering lifestyle, increasing alcohol use, and increasing emotional stress.[7] Hence, the aim of our research is to study the occurrence of cardiac diseases in COVID-19 inpatients in rural Telangana, India, during different times of lockdown.

METHODS

The current study is a single-centre retrospective epidemiological analysis that included patients (n=1320) who visited the cardiology department of a teaching multispecialty hospital in Siddipet district, Telangana between 17 January and 6 August, 2020. The information was gathered from the 25 March to the 31 May, during the lockdown as well as the pre-lockdown phase from 17 January to 24 March and the post-lockdown period from 1 June to 6 August. The medical records of all admitted cardiac patients served as the data source. During the lockdown, a triage area was set up in hospital hallways, as per government regulations. Before contacting any department, each person entering the hospital was thermally checked and given a short questionnaire to complete. Symptoms like cough, sore throat, fever, and shortness of breath, as well as travel and exposure history were included in the questionnaire. Non-modifiable risk factors renal illnesses history of previous strokes and peripheral or cardiac vascular diseases, and modifiable risk factors hypertension, diabetes, and smoking were included in the study. RT-PCR testing for COVID-19 was made mandatory for all inpatients. Medical history, risk factors, and a family history of heart disease were all gathered. If a male first-degree relative experienced heart illness before the age of 55 or a female first-degree relative before the age of 65, the family history for heart disease was considered positive. If the patient had signs of heart illness, an electrocardiogram (ECG) and two-dimensional transthoracic echocardiogram (2D ECHO) were done. The 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation and "the fourth universal definition of myocardial infarction-2018" were used to look for abnormal ECG findings. Cardiac disorders were diagnosed using the latest ACC AHA classifications [8-10]. Patients with motion wall abnormalities were detected if left ventricular (LV) ejection fraction was less than 50% on 2D ECHO and pericardial fluid >5 mm indicated pericardial effusion. Patients having a history of trauma were referred to other departments and were not included in the study. The data was analysed using Microsoft Excel program and IBM SPSS version 21.

RESULTS

A total of 1320 patients visited for cardiac consultation during the study period of which 770 patients were seen in prelock down period, 99 patients in the lockdown period and 451 patients in the post lockdown period. A total of 13.1% (n=101) cardiac patient were admitted in the prelock down period while 18.2% (n=18) in the lock down and 16.4% (n=74) in the post-lockdown period. In addition, a significant increase in the number of admissions of cardiac patients under 40 years old was seen in the post lockdown (39.4%; n=30) and lockdown period (21.1%; n=4) compared to 14.9% (n=15) in the prelock down period. In the late lockdown period, i.e., last week of May 2020, 82% of COVID-19 cases were urban, but just 21% of the cardiac admission were seen in the urban area by the end of late post lock down period i.e., August 2020. However, there was no significant difference in the distribution of disease prevalence between males and females.

Myocardial Infarction was the most common disease that accounted for nearly 84.7% of the inpatient's subjects during the total study period. The admission rate of patients with STEMI (53.4% prelock down vs. 36.8% post lockdown, 26% lockdown) and arrhythmia decreased (7.3% pre lockdown vs. 1.3% post lockdown) after the initiation of lockdown period while myopericarditis patients increased significantly (1% pre lockdown vs. 10.5% lock down, 9.2% post lockdown). Further, STEMI (mean age 42.07±15.06) and myopericarditis (mean age 30.8±9.02 years) was seen in very young inpatients (mean age 30.8±9.02 years). All COVID-19 positive patients had chest pain, regional motion wall abnormality on ECHO, and had obstructive coronaries, 22% showed diffused ST-segment elevation, 56% ST elevation, 78% focal ST-segment elevation while 36% had a normal echocardiogram. Further, all of the patients with RV and LV failure had ECG abnormalities, dyspnea, or chest discomfort, and no history of fever or cough. There were no significant differences seen in the admission rate of cardiac patients with N-STEMI, PE, LVHF and rheumatic heart failure as well as the procedure rates of CAG and PTCA. Of the total 197 inpatients, the mortality rate was

6.6% (n=13) during hospitalization. 53.7% of the deaths that occurred were due to STEMI (n=7) followed by 13.3% myopericarditis (n=2) in young adults and one case each of NSTEMI after acute decompensated heart failure, acute stent thrombosis and subacute thrombosis, one of ventricular septal rupture post PCI and one acute arrhythmic (Table 2).

Table 1: Demographic findings of the cardiac patients admitted during the lock down periods in rural Indian population.

Characteristic	Total	Pre-lock down N (%)	Lock down N (%)	Post lock down N (%)	P value
Patients visited	1320	770 (58.3)	99 (7.5)	451 (34.1)	0.094
Patients admitted	196	101 (13.1)	19 (19.2)	76 (16.8)	
Sex					
Male	110 (56.1)	56 (55.4)	10 (52.6)	44 (57.9)	0.900
Female	86 (43.9)	45 (44.6)	9 (47.4)	32 (42.1)	
Age (years)					
Less than 30	9 (4.6)	5 (5)	0 (0)	4 (5.3)	0.013
31-45	49 (25)	15 (14.9)	4 (21.1)	30 (39.5)	
46-60	85 (43.4)	47 (46.5)	8 (42.1)	30 (39.5)	
61-75	43 (21.9)	27 (26.7)	6 (31.6)	10 (13.2)	
Greater than 75	10 (5.1)	7 (6.9)	1 (5.3)	2 (2.6)	
Procedures					
Coronary angiogram procedure	142 (63.7)	64 (84.2)	11 (57.9)	57 (75)	0.172
Percutaneous transluminal coronary angioplasty (PTCA)	81 (36.3)	38 (37.6)	6 (31.6)	27 (35.5)	0.870

Table 2: The prevalence of cardiac diseases in admitted patients during the lock down periods in rural Indian population.

Heart disease	Total	Pre-lock down N (%)	Lock down N (%)	Post lock down N (%)	P value
Patients admitted	196	101 (13.1)	19 (19.2)	76 (16.8)	-
Non-ST-elevation myocardial infarction	79 (38)	37 (36.6)	9 (47.4)	33 (43.4)	0.500
ST-segment elevation myocardial infarction (STEMI)	87 (41.8)	54 (53.4)	5 (26.3)	28 (36.8)	0.083
Pulmonary embolism	6 (2.9)	3 (3)	1 (5.3)	2 (2.6)	0.833
Left ventricular heart failure	8 (3.8)	5 (5.0)	0 (0)	3 (3.9)	0.944
Myopericarditis	10 (4.8)	1 (1.0)	2 (10.5)	7 (9.2)	0.024
Rheumatic heart disease (RHD)	9 (4.3)	5 (5.0)	2 (10.5)	2 (2.6)	0.328
Arythrymeias	9 (4.3)	8 (7.9)	0 (0)	1 (1.3)	0.072

DISCUSSION

Acute coronary syndrome (ACS) is a medical emergency that comprises ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), or unstable angina (UA) and requires prompt diagnosis and treatment. The American College of Cardiology, European Society of Cardiology, and Cardiological Society of India recommended maintaining separate catheterization facilities, using the fibrinolytic treatment for STEMI, and delaying revascularization for NSTEMI during the pandemic period.[11] In addition, managing ACS has been difficult because the symptoms of ACS and COVID-19 are identical. During the early COVID-19 pandemic era, Filipo et al from Italy observed a significant reduction in the rate of ACS hospital admissions from 18% to 13.2% per day, while Soloman et al 2020 in the American population observed a reduced incidence rate from 4.1/100000 to 2.1/10000).[12-14] Garcia et al, 2020 observed a 38% decrease in cardiac catheterization laboratory activation in nine high-volume centres in the United States during the lockdown time.[15] In addition, during the COVID-19 pandemic in Taiwan, there was a major delay in receiving medical assistance.[16] The current study also discovered a significant reduction in the number of patients visiting the hospital during the lockdown period (only 99 out of 1320 patients) compared to the post-lockdown period (452 patients), which could be due to the study center's rural location and personal

transportation inaccessibility. Fear of contracting COVID-19, changes in lifestyle, and environmental factors have all been linked to a lower rate of hospitalisation for cardiac illnesses during the start of the pandemic.[17] However, the high admission rate during the lockdown period (18.2%) compared to the post-lockdown (16.4%) and pre-lockdown (13.2%) periods of the study suggests that COVID-19 manifests as serious coronary heart disease. Furthermore, the considerable decline in urban population at the end of the post-lockdown period showed an increase in rural infection spread, which is consistent with Eric et al 2020's FLU SURV-NET cross-sectional study.[18]

During the COVID-19 pandemic, cardiac damage was the most common disease among hospitalised patients with elevated troponins, fake STEMI or NSTEMI mimics, and viral myocarditis in Wuhan, China.[12] STEMI was the first sign of COVID-19 in 85.7% of individuals without obstructive coronary artery disease in Lombardy, Italy.[19] Earlier studies conducted during the lockdown period reported a reduction in the admission of STEMI and NSTEMI cases in Milan, Madrid, United States, Italy, Spain, Austria and England while reduced hospitalization of only NSTEMI was noticed in studies of UK and Germany. However, the occurrence of ACS during the lockdown was similar to non-COVID-19 periods in the study from France Canada, and Taiwan.[20-26] The current study finds MI to be the most common cardiovascular disease in inpatients during the study period (more than 70%), while hospitalization of only STEMI subtype patients decreased during the lockdown period, which contradicts studies conducted in the United Kingdom, Canada, France, and Taiwan.[17,20,26] Furthermore, only 34.4% of STEMI cases were managed by fibrinolytics in the current study since most of the patients were late for therapy and outside the thrombolytic window period. The presence of increased troponin and either echocardiographic or electrocardiographic abnormalities is required for the diagnosis of ACS.23 In a cohort study conducted by Banglore et al 2020 involving 112 COVID-19 individuals with myocardial damage, the STEMI-like pattern on ECG was detected but there was no localized motion wall abnormalities or lower left ventricular ejection fraction (LVEF) and only 33% of them had chest pain.[27]

In a multicentric cohort study involving 191 COVID-19 patients, echocardiographic tests revealed 39% RV dilation and dysfunction and 10% LV systolic dysfunction. Inciardi et al discovered that cardiovascular problems can appear without respiratory symptoms in COVID-19 patients.[29] In agreement to the study conducted by Inciardi et al the present study also find in cardiac patients presented without symptoms concerning the respiratory system. Furthermore, all of these patients had obstructive coronaries, 22% diffused ST-segment elevation, 56% ST elevation, 78% focal ST-segment elevation while 36% having a normal echocardiogram. Further, all of the patients with RV and LV failure had ECG abnormalities, dyspnea, or chest discomfort, and no history of fever or cough.

Cardiac arrhythmias (CA) are another typical cardiac manifestation in COVID-19 infected patients. CA was seen in 16.7% of a Chinese sample, with COVID-19 ICU patients having the highest rate.[3] A recent meta-analysis of COVID-19 patients with heart damage and new arrhythmias found severe illness that frequently resulted in death.[25] In contrast to previous research, the current study indicates a decrease in arrhythmia admissions (6.3% prelockdown vs. 1% lockdown). Only three patients were admitted with acute decompensated heart failure (ADHF), one with supraventricular arrhythmia and the other two with longstanding ischemic heart disease related to ventricular arrhythmia. They were readmitted with angina during the lockdown and were managed by angiographies and subsequent angioplasties. Pulmonary embolism was reported as a rare presentation of CHDs by Casey et al and Ahmed et al.[30,31] In contrast to previous investigations, the current study found six admissions for pulmonary embolism following the start of lockdown. One of the five patients with pericardial effusion was moderately severe, necessitating pericardial tapping and antitubercular therapy. Acute cor pulmonale (ACP) is reported to be present in critically ill patients with COVID-19.[32] In the present study patients of ACP (N=3) were young (below 40 years). One of the patient presented with acute right ventricular failure (RV) and acute kidney disease with normal CT chest and CT pulmonary angiogram while the other COVID positive patient showed segmental wedge-shaped opacification in lungs and had RV dilation and T wave inversion in anterior leads in transthoracic echocardiography.

Earlier studies conducted in China, US, Iran and Italy has reported male preponderance in COVID-19-associated hospitalization rates.[11-14,28] Further, a study conducted by Filipo et al., 2020 in the Italian population reported a mean age of patients as 68±12 years of which 45.3% were with STEMI.[13] Studies from India also reported 95% male admissions of STEMI patients with a mean age of 60.23±9.97 years in the COVID-19 pandemic.[33] Patil et al found that, mostly male, sex, smoking, low HDL levels, and abdominal obesity, lack of awareness and lack of available prevention strategies played a major role in the causation of premature coronary artery disease among the rural youth in the Indian population.[34] In agreement with Patil et al., the present study also finds, more young patients in the COVID-19 during the lockdown and post lockdown period but without any history of cardiac disease or predisposition to risk factors which may indicate the influence of the pandemic on acute cardiovascular events as previously reported by Eric et al.[18] A significant increase in myopericarditis admissions was noted after the lockdown period (10.5% vs. 1.3%). with a mean age of 30.8±9.02 years of which 66.6% were found to be COVID-19 positive. However, the present studies do not find the difference in the male-female ratio and procedure rates of CAG and PTGA of the

hospitalized patients in the three-time periods. A metanalysis study conducted on studies from different countries on the cardiac patients during the COVID pandemic also found significantly high mortality across all countries and was more prevalent in older adults when compared to younger and healthier individuals. However, the hospital admission rate, severity, and mortality were also found in younger adults.[32,35-37] Bangalore et al reported 18 COVID-19 patients with ST-segment elevation of which 22% died of myocardial infarction whereas 50% died of non-coronary myocardial injury.[27] Echocardiographic changes seen in myocarditis patients were linked with severity and mortality in COVID-19 patients.[38-40] In a cohort study conducted by Shi et al., 2020 on 416 COVID-19 inpatients in Wuhan, China, myocardial injury manifested in 19.7% and a significantly higher mortality rate of 51.2% compared with those without myocardial injury (4.5%).[5] The present study has noticed higher mortality of admitted patients in the post lockdown period of which 53.7% (N=7) deaths were due to myocardial infarction. The results of the present study are in agreement with a recent study conducted in Indian population which finds an overall COVID-19 related mortality to be low in the health and resource-challenged population of Indian subcontinent. Availability of universal health care, social culture, individual genetic variation, genetic or acquired differences in certain immune variations, and high proportion of Indian population constituted by young age individuals compared to western countries, and genetic variations in SARS-CoV-2 could be linked for low fatality rate in India.[41,42] In Oceania, Australia and New Zealand, also reported relatively low mortality compared to other countries possibly as a result of the various hygiene measures taken up to control transmission of COVID-19.[25]

CONCLUSION

Though the present study indicates low mortality rate in Indian population it provides the data for linking cardiac diseases and COVID-19 pandemic with severity and mortality risk in young age patients of the South Indian rural population. The observations noted should help to conduct further studies for the identification of yet-to-be-determined risk factors and mortality among different races, regions, and ethnicities.

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