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Research Article

POST-COVID CARDIOVASCULAR MANIFESTATION AMONG THE PATIENTS ATTENDING TERTIARY CARE HOSPITAL IN CHHINDWARA: A QUALITATIVE STUDY

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ABSTRACT

Objectives: The objectives of the study were to assess the cardiovascular manifestations in hospitalized and non-hospitalized patients with COVID-19.

Methods: All patients, attending to the dedicated post-COVID outpatient department of Medicine Department, Chhindwara Institute of Medical Sciences from April 2021 to March 2022, with a history of positive RTPCR for severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) at least 2 weeks before presentation, were included in the study. Questionnaire along with patients echocardiogram and echo report, Canadian classification used for angina grading and NYHA classification to classify shortness of breath. A total of 650 patients were assessed for demographics, pre-existing comorbidities, health status, date of symptoms onset, COVID-19 diagnosis, health-care utilization, and the presence of any cardiac or other symptoms at the time of the onset of symptoms (retrospectively) and at follow-up days after symptoms onset.

Results: The mean age of the sample (n=650) was 50.34 years. Majority were 346 (53.23%) males. According to responses using Canadian classification for chest pain were 75 (12.5%) Class 2 angina, in NYHA classification, majority 480 (80%) of patients had Class 2 SOB. About 90 (15%) of patients echo showed positive echo findings. The average stay of patients was 7.58+–1.6 days. About 135 (22.5%) of post-COVID patients had cardiac manifestations, majority were male 118 (87.4%). One hundred and two (75.5%) of patients that developed cardiac manifestation had multiple comorbidities, AF (6%) was reported in patients age 62 years and above. NSTEMI was reported in patients with multiple comorbidities.

Conclusion: As the SARS-CoV-2 pandemic progresses, the interactions between coexisting cardiovascular disease and acute cardiovascular manifestations have a major implication on the medical community's understanding of this disease. This suggests the presence of a post-COVID-19 syndrome and highlights the unmet health-care needs in a subgroup of patients with mild or severe COVID-19.

Keywords: Post-COVID, Cardiovascular manifestations, COVID-19.

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INTRODUCTION

In early December 2019, there was a rise in unusual pneumonia cases presenting in city Wuhan, China. The cause of which was found to be SARS-CoV-2 [1]. Coronaviruses comprises large family of single positive-stranded, enveloped RNA viruses that can infect various animal species and humans. The viruses infecting humans can be classified on the basis of their pathogenicity, out of the other classes, some strains having high pathogenicity are SARS-CoV, MERS-CoV, and current novel SARS-CoV-2 [2]. This virus spreads through droplets in the respiratory secretions. A person can get infected by contact of mucus membrane (nose, eyes, or mouth) with the respiratory secretions of an actively infected person discharging virus particles [3]. Many COVID-19 patients have been reported to have cardiac injury although the exact pathophysiology and mechanism of injury remains poorly understood [4]. COVID-19 induces multiple cytokines and chemokines release resulting in vascular inflammation, plaque instability, and myocardial inflammation [5]. A pre-existing cardiovascular disease (CVD) predisposes a COVID-19-infected patient with elevated risk of adverse outcomes [6]. In addition to this, many studies show that patients with pre-existing coronary artery disease and/or risk factors for atherosclerotic disease are more prone to develop acute coronary syndrome ACS during acute infection phase [7]. Some previous study reports suggest direct injury to the myocytes by virus that may lead to inflammation and cardiac injury [8]. It has been suggested that the primary mechanism of severe acute respiratory syndrome-coronavirus-2 entry into host cells is through angiotensin-converting enzyme 2 (ACE2) receptors that are abundantly expressed on the heart and lung cells [9]. Many studies show a high prevalence of cardiovascular comorbidities in hospitalized patients affected by the COVID-19 virus [10]. Many studies show that having risk factors for cardiac disease and established CVD seem to have more vulnerability to COVID-19 and show more severe disease with worse clinical outcomes. In case report study of 138 hospitalized COVID-19 patients by Wang *et al*. [1], 14.1% had baseline CVD and 31.1% had hypertension. In a study of 41 patients by Huang *et al*. [3], 14.6% were having a baseline CVD and 14.6% were having hypertension. Whereas in a larger cohort of 416 patients by Shi *et al*. [11], 30.5% had hypertension, 10.6% had coronary artery disease, and 5.3% had CVD. The prognostic significance of CVD was seen in a cohort of 191 patients by Zhou *et al*. [12], showing that 30% had hypertension that constituted 48% of the non-survivors, and patients already having CVD were 8% who made 13% of non-survivors. Despite former reports, the full spectrum of CV manifestations of COVID-19 has to be explored in the direction of CVD. Although, the present study has to fulfill the gap-related cardiovascular manifestations in COVID or post-COVID patients.

Aim and objectives

The main purpose of this study was to find the frequency of cardiac diseases in post-COVID-19 patients and CVS manifestations in corona cases attending post-COVID outpatient department (OPD) in tertiary care hospital of CIMS, Chhindwara.

1. To find out the spectrum of cardiac diseases occurring in post-COVID patients
2. To find if pre-existing CVD predisposes COVID-19 patients or attendees of post-COVID OPD with elevated risk of adverse outcomes.

METHODS

A cross-sectional study was conducted at tertiary care center of Chhindwara Institute of Medical Sciences from April 2021 to March 2022 after getting the permission from the Institutional Ethical Committee, CIMS, Chhindwara (MP). All patients attending post-COVID OPD were included and also admitted patents in dedicated COVID ward and COVID intensive care unit (ICU) were enrolled. Our sample size was 686 but 36 patients were not filled the study pro forma completely and also given the incomplete information so that during data cleaning, we were excluded them from the study, now sample size came to 650. Informed written consent was taken from all the study participants. The patients admitted in wards/ICU were allowed to respond in their own time and privacy. The participation was entirely voluntary. A self-designed questionnaire was administered and patients echocardiogram (ECG) and echo report were attached with the questionnaire.

Functional definitions: [13]

Chest pain

Canadian classification was used to grade chest pain.

1. "Ordinary physical activity does not cause angina," such as walking and climbing stairs. Angina with strenuous or rapid or prolonged exertion at work or recreation
2. "Slight limitation of ordinary activity." Walking or climbing stairs rapidly, walking uphill, walking or stair climbing after meals, or in cold, or in wind, or under emotional stress, or only during the few hours after awakening. Walking more than 2 blocks on the level and climbing more than 1 flight of ordinary stairs at a normal pace and in normal conditions
3. "Marked limitation of ordinary physical activity." Walking one to two blocks on the level and climbing one flight of stairs in normal conditions and at normal pace. IV. "Inability to carry on any physical activity without discomfort- anginal syndrome may be present at rest."

Shortness of breath

NYHA classification was used to asses SOB.

- Class I – No symptoms and no limitation in ordinary physical activity, for example, shortness of breath when walking, climbing stairs, etc
- Class II – Mild symptoms (mild shortness of breath and/or angina) and slight limitation during ordinary activity
- Class III – Marked limitation in activity due to symptoms, even during less than ordinary activity, for example, walking short distances (20–100 m). Comfortable only at rest
- Class IV – Severe limitations. Experiences symptoms even while at rest. Mostly bed bound patients.

Ischemic heart disease

Also known as coronary heart disease, occurs when atherosclerosis affects the coronary arteries in the heart hence the blood flow to the heart muscle is reduced because of a partial or complete blockage of the arteries supplying it with blood, angina, or a heart attack may occur.

Valvular heart disease

It is any CVD process involving one or more of the four valves of the heart, leading to structural or functional abnormality.

Myocarditis

Myocarditis is inflammation of the heart muscle (myocardium). The inflammation of the heart muscle causes degeneration or death of heart muscle cells. Myocarditis has many different causes and can result in a range of outcomes from mild (presenting briefly and resolving) to rapidly progressing fatal disease.

Pericardial effusion

Pericardial effusion is the buildup of extra fluid in the pericardial space. If too much fluid builds up, it can cause cardiac tamponade.

Heart failure

It is defined as when the heart fails to keep up with its load.

Reduced ejection fraction

The term "ejection fraction" refers to the percentage of blood that is pumped out of a filled ventricle with each heartbeat. In heart failure patients, ejection fraction is less than normal.

- HF with preserved ejection fraction (HFpEF): LVEF ≥50%
- HF with a mid-range ejection fraction (HFmEF): LVEF 41–49%
- HF with a reduced ejection fraction (HFrEF): LVEF ≤40%.

Arrhythmias

A cardiac arrhythmia is a disturbance of the electrical rhythm of the heart. It can be classified into

- Tachyarrhythmia having heart rate >100 bpm
- Bradyarrhythmia having heart rate <60 bpm

RESULTS

The mean age of sample was 56+1.6 years, range 18–72 years. There were 346 (53.23%) males and 304 (46.76%) females, majority of the sample was from post-COVID OPD 556 (85.53%) whereas 83 (12.76%) were from dedicated COVID ward and 11 (1.69%) COVID ICU setup, from tertiary care hospital of CIMS. According to responses of patients using Canadian classification for chest pain, there were 119 (18.30%) Class 2 angina, 78 (12.0%) Class 3, and 46 (7.07%) Class 4 angina cases. In our results, patients through NYHA classification were classified as, about 480 (80%) of patients had Class 2 SOB. Patients with oxygen therapy 468 (72.0%) maintained oxygen above 92% and 182 (28.0%) had below 92% SpO_2 despite oxygen therapy. Other common CVS symptoms experienced were palpitations, fatigability, intermittent claudication, and syncope out of which about 8% of patients presented with palpitations, 98% of patients presented with fatigability, 1% of patients had intermittent claudication, and 9% suffered from syncope. About 12% of patients had positive troponins, that is, above 0.40 cutoff. The average stay of patients came out to be 7.58±1.6 days with max stay of 48 days to min of 2 days (range 2–48). About 22.6% of mortality was noted in our sample, majority of expiry were from COVID ICU about 56.55% and rest 43.45% were from ward. About 78.6% of patients were discharged. About 19.8% of patients echo showed IMP LV/LV dysfunction and showed low EF LVEF ≤40%. In our results, about 85.4% of patients ECG were normal and 15.6% showed abnormal ECG patterns having arrhythmias and ST-T changes 2.6%, bradycardia, 6% AF, 2.8% of STEMI, and 5.1% of NSTEMI. About 9.5% of population had an acute event and 73.5% of which occurred in three comorbidity patients.

Comorbidities

About 61.3% had hypertension, 74.6% had diabetes type 2, 12% had CAD, 9% of patients had three comorbidities, and 36% of patients had

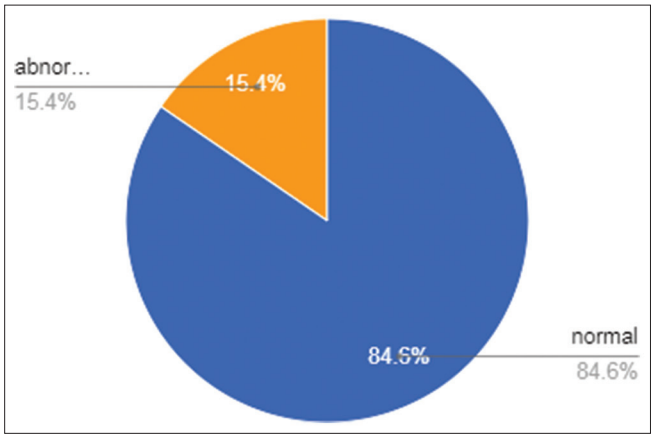

Fig. 1: Comparison of normal ECG proportion with abnormal pattern in COVID patients

more than 1 comorbidity. About 24.5% of COVID patients had cardiac manifestations, 19.5% was from ICU, and 81.5% was from ward, with an average age of 63.7 years (range 45–72), majority of which were male about 87.5% and females had 12.5%. Average stay of patients was 7.58 days. About 25% of patients developing cardiac manifestation had single comorbidity whereas 75% of patients that developed cardiac manifestation had multiple comorbidities. AF was reported in patients age 62 and above with single comorbidity (Hypertension [HTN] or diabetes mellitus [DM]) or both (HTN and DM). NSTEMI was reported in patients with multiple comorbidities, that is, HTN, Coronary artery disease, DM, male sex, and age above 50. About 85.99% of COVID patients did not have cardiac manifestations. About 85.53% of patients were from post-COVID OPD, 1.69% of patients were from ICU, and 12.76% were from ward, with an average age of 58.72 years (range 18–72), with males (53.23%) and females made 46.7%. About 25.07% of patients had single risk factor for cardiac disease and 74.7% with multiple risk factors. Average stay of patients was 7.58 days.

Table 1 : Baseline characteristics of post-COVID-19 patients presenting to follow-up outpatient department at tertiary hospital (n=650)

Baseline characteristics	Frequency, n (%)
Gender	
Male	346 (53.23)
Female	304 (46.7)
Age group (years)	
<20	44 (6.8)
20–39	152 (23.4)
40–59	76 (64.4)
60 and above	26 (22)
Comorbidities	
Hypertension	406 (62.5)
Diabetes mellitus	487 (74.8)
Chronic respiratory diseases	114 (17.6)
CAD	78 (12.0)
Hypothyroidism	44 (6.8)
Psychiatric illness	27 (4.2)
Cerebrovascular disease	5 (0.8)
Rheumatoid arthritis	5 (0.8)
Seizure disorder	5 (0.8)
None	347 (53.4)
Time since diagnosis of COVID-19 at first follow up (weeks)	
3–4	435 (66.9)
5–6	138 (21.2)
7–8	49 (7.6)
9–12	16 (2.5)
>12	11 (1.7)

CAD: Chronic airway disease

Table 2: Increase in risk factors increases the chances of cardiac disease with COVID-19 (n=650)

Serial number	Risk factors	Cardiac manifestations, n (%)
1	1	163 (25.07)
2	2	234 (36.0)
3	>2	253 (38.92)

Table 3: t-test of severity of cardiac manifestation and noncardiac manifestation COVID patients (n=650)

	Cardiac manifestation, n (%)	Non-cardiac manifestation, n (%)	p
Mild	168 (25.84)	274 (42.15)	0.0014
Moderate	84 (12.92)	196 (30.15)	0.0032
Severe	48 (7.38)	89 (13.69)	0.0047

p<0.05 is statistically significant

LABS values

The average creatinine levels were 0.8733 and 9.3% of patients had deranged creatinine levels above 1.1. The average CRP levels were 16.15 (range 60–3) and D-dimers were around 1653.8 (range 9000–100), TLC of 1.49E+04 (range 3.00E+04–5+03); all the inflammatory markers were deranged and elevated; the average SGPT levels were around 45.186 (range 418–7); and RBS was on average 158.62.

Fig. 2 shows that 6.2% of patients had AF, 2.5% of patients had bradycardia, 5.2% of patients had ST-T changes, and 2.5% of patients had STEMI.

DISCUSSION

Our study showed that 11 (1.69%) were from COVID ICU setup, about 83 (12.76%) of patients were present from the COVID ward and 556 (85.53%) patients were from post-COVID OPD setup. Shortness of breath was the most common complaint reported by 80.0% of patients at mean follow-up duration of 28 days in our study. In a study done in Italy by Carfi *et al*., fatigue (53.1%) and dyspnea (43.4%) were the most common complaints of post-COVID-19 patients at mean follow-up duration of 60 days [14]. Neurological symptoms such as anosmia/hyposmia and ageusia/dysgeusia were found to be persistent in 49.2% and 45.8% of patients at their first follow-up visit. One patient reported perception of foul smell and altered smell pattern suggestive of parosmia even after 3 months of mild COVID-19 infection. Post-infectious olfactory dysfunction in the form of misperception of existing odors has been previously reported as a delayed complication following COVID-19 [15]. Our study shows that arrhythmias and shock were present in hospitalized patients

Table 4: Symptomatology during COVID-19 illness of post-COVID patients presenting to follow-up outpatient department (n=650)

Serial number	Symptoms	Frequency, n (%)
1	Fever	88 (74.6)
2	Myalgia/body ache	88 (74.6)
3	Cough	87 (73.7)
4	Shortness of breath	71 (60.2)
5	Anosmia/hyposmia	58 (49.2)
6	Ageusia/dysgeusia	54 (45.8)
7	Headache	50 (42.4)
8	Chest pain	75 (12.5)
9	Decreased appetite	Decreased appetite
10	Diarrhea	34 (28.8
11	Sore throat	30 (25.4)
12	Runny nose	24 (20.3)
13	Nausea/vomiting	17 (14.4)
14	Dizziness	14 (11.9)
15	Abdominal pain	7 (5.9)
16	Hemoptysis	3 (2.5)

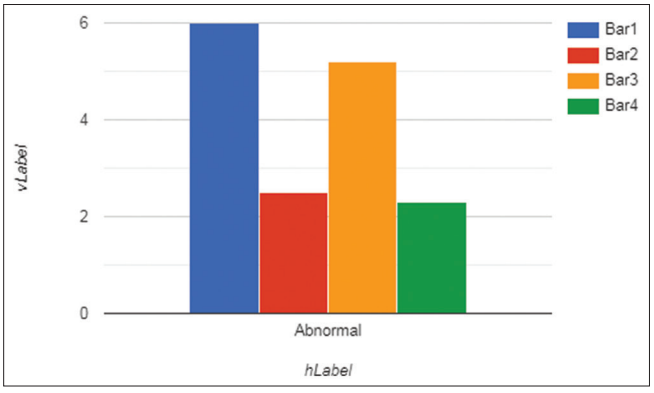

Fig. 2: Abnormal ECG patterns observed in COVID patients

which are favored by the findings of major complications during hospitalization included ARDS, arrhythmia, and shock [1]. Our result showed that 8% of patients showed palpitations which is favored by the results of study by of 137 patients that 7.3% reported palpitations as one of their symptoms [16]. In our study, 5.2% of patients showed ST-T changes, which is in favor by the research findings of that ACS was noted in 33% of patients presenting with ST elevation, likewise, there were case reports by favoring our results that patients showed ST-T changes [17-19]. Our findings are supported by that most critically ill patients were older and had more underlying conditions than patients not admitted to the ICU [1]. Our study findings were similar with the findings of that patients with pre-existing cardiovascular comorbidities are presenting with severe cases of COVID-19 infection [9,20].

Our study showed that 53.23% of males got COVID which is favored by the findings of Chen *et al*. [21] showed that 2019-CoV infection is more likely to affect males and [22] that females may be less susceptible to the virus due to the protective effects of the X chromosome and sex hormones 27 and is against the finding of Wang *et al*. [1] that there was no difference in the proportion of men and women between ICU patients and non-ICU patients. Our study supports the findings of that most patients required oxygen therapy and a minority of the patients needed invasive ventilation [1]. Our study showed that 61.3% of patients had HTN, 74.6% had DM, 12% had cad which is similar to the findings of the following researches by Huang *et al*. [3] that 14.6% were having a baseline CVD, and 14.6% were having hypertension and a cohort by Shi *et al*. [11] that 30.5% had hypertension, 10.6% had coronary artery disease, and 5.3% had CVD. Our findings do not support the findings of [1] cohort that the overall rates of severe hypoxia and invasive ventilation were higher but supports the findings of Huang *et al*. [3], rates of severe hypoxia and invasive ventilation were low, it might be due to the fact that cases in the previous study were from the early epidemic stage and the current cases are from the stage of outbreak and mid of ongoing wave. Our study supports the findings of that >60 years old was a predictor for adverse outcomes [23]. In our findings, males were having more cardiac manifestations which are favored by the findings of Xu *et al*. [23] that female was found to be protective against death and adverse outcomes approximately 5-fold time increase in the risk of death as well as adverse outcomes in males. Further and detailed evaluation of the impact of different comorbidities on patients with COVID-19 is necessary and of great value to guiding proper interdisciplinary management, especially for elderly patients. Our study supports the findings of recent studies by Zheng *et al*. [9], Du *et al*. [24], Li *et al*. [25] that patients with severe cardiovascular damage and underlying cardiac insufficiency were associated with adverse events. This study has several limitations: First, of all limited to time and finite resources and, second, limited exposure to prevent spread and selection bias in recruiting only admitted patients.

CONCLUSION

Our study had several limitations. First, the observational nature of this study introduces selection bias related to admitted and monitored patients with COVID-19. The incidence and severity of COVID and cardiac manifestations in non-hospitalized patients and patients with mild illness at home are unknown. Males are more prone to COVID and having more cardiac events. Age above 50 years develops more serious disease and adverse outcomes. Cardiovascular comorbidities are common in patients with COVID-19 and such patients are at higher risk of morbidity and mortality. Our findings show that more the comorbidities worse is the outcome and along with respiratory problems, many CVS manifestations are seen in COVID patients.

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CONFLICTS OF INTEREST

None declared.

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Nil.

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