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COVID-19 INFECTION AND HEART BLOCK:COMORBIDITIES,HOSPITAL COURSE AND TWO YEARS FOLLOW UP.

Cardiology

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ABSTRACT

Background: Since the emergence of the SARS COV-19 pandemic, multiple extrapulmonary manifestations of the virus have been reported from around the world. Cardiovascular complications including bradyarrhythmias in patients have been described in multiple studies, however long term followup is scanty. Our aim was to study the outcome of heart block patients with COVID-19 infection and to assess the clinical course of these patients over a period of two years. **Results:** A total of 12 patients with heart block and COVID -19 infection were identified. Among them, 75% (n=9) of patients suffered from at least one comorbidity viz, diabetes, HTN, coronary artery disease. 83% (n=10) of the patients had persistent heart block, out of them 9(75%) were implanted with a permanent pacemaker respectively. The mortality rate was 25% (n=3) during hospitalization. They had multiorgan failure and shock. Two patients were suspected of having myocarditis. **Conclusions:** COVID-19 patients has significant implications on the clinical course and prognosis of patients especially with comorbidities. Cardiovascular complications significantly affect the outcomes in these patients. Physicians must realize the importance of monitoring patients hospitalized for COVID-19 for arrhythmias including heart block. Early detection can improve the prognosis of the patients.

KEYWORDS

Complete Heart Block; COVID-19; multiorgan failure; Myocarditis

BACKGROUND

Since the first reports of atypical pneumonia in Wuhan province of China, the coronavirus disease 2019 (COVID-19) has evolved into a major world health issue. Although pneumonia is the most significant manifestation of severe acute respiratory syndrome coronavirus-2 (SARS CoV-2) infection[1] , a range of extra-pulmonary manifestations have been reported, such as venous thromboembolism, cardiac complications, gastrointestinal abnormalities, acute kidney insult, hepatocellular injury, hyperglycemic state, neurological illnesses, dermatological complications[2], preterm labour and increased caesarean section rate.[3]14.1% of hospitalized COVID-19 cases have been reported to develop cardiovascular abnormalities which mainly include acute coronary syndrome, arrhythmia, and acute heart failure[4]; although patients with fulminant myocarditis, pericarditis, cardiac tamponade, Takotsubo cardiomyopathy, and cor pulmonale have also been described[5–8]. It is recognized that cardiac involvement in COVID-19 leads to a worse prognosis.[9] Ventricular arrhythmias, atrial arrhythmias, sinus bradycardia, heart block, ST-segment changes, and prolonged QTc have all been reported in COVID-19 patients. Meta-analyses have estimated the arrhythmia incidence rate in patients hospitalized for COVID-19 to be from 6.9% to 10.3%.[9,10] who passed away due to heart block Heart block is the least documented form of arrhythmia that is seen in COVID-19 patients and the incidence, nature, and impact of this type of arrhythmia among COVID-19 patients is yet to be studied. Hence, the aim of this study is to understand potential patterns of heart block, association with pre-existing comorbidities, and the effect on the clinical course including the outcome of heart block in this group of patients.

METHODS

Screening and Inclusion Criteria: All heart block patients who tested positive for COVID-19 , confirmed by RTPCR between march 2020 to march 2022.

Exclusion Criteria: Heart block patients who tested negative for COVID 19 as confirmed by RTPCR.

Heart block associated with Acute Coronary syndrome or post cardiac surgery.

Heart block associated with metabolic derrangements like hyperkalemia.

RESULTS

Our study included 12 patients with complete heart block, who tested positive for COVID-19 infection by RTPCR. Table 1 summarizes the baseline characters of the patients. Age of the patients varied from 40 to 85 years with mean of 64.1(SD=11.67) years. Out of 12 patients, nine (75%) were males and three (25%) females. Mean hemoglobin was 12.6 g%(SD=3.3 g%). A mean WBC count of 9.35x10*3(SD=3.3x10*3) per ml and a mean platelet count of 110.4x10*3(SD=34.5x10*3), mean neutrophil count of 78.2% and lymphocte count of 12.7%. Troponin were positive in two patients suspected of myocarditis and negative in rest. Echo was done in ten patients, nine of them had normal LV systolic function and no regional wall motion abnormality. One patient had history of inferior wall MI in past and echocardiography revealed hypokinesia in right coronary artery(RCA) territory. Ten patients had persistent heart block. Permanent pacemaker(PPM) was implanted in 9(75%) patients. Four patients received dual chamber pacemaker and remaining five were implanted with single chamber PPM. Three patients with heart block had multiorgan dysfunction syndrome(MODS) with shock, including two suspected of myocarditis who were implanted with temporary pacemaker. The third patient had underlying HTN, interstitial lung disease and right bundle branch block(RBBB) and was admitted as severe COVID-19 illness. She developed complete heart block during hospital course but refused temporary pacemaker support. All the three(25%) patients with MODS died in hospital. Two patients with MODS admitted with CHB died within 24 hours and the third patient who developed CHB during hospital course died on 7th day (2 days after CHB). All the three patients with MODS had respiratory failure requiring oxygen support and significant lymphopenia was common to all the three patients who died(3.7%, 8.2%, 5.3%). The most common biochemical derrangement seen was elevated serum LDH levels in 7(58%) and the most common hematological abnormality seen was relative neutrophilia with or without increased total WBC count. All nine patients implanted with PPM were discharged in a stable state. Close follow up at day 3, day 7, 6 weeks, 6 months, 12 months and 24 months was observed. All the nine patients are doing well on follow up. While multiple hypotheses exist to explain conduction disturbances in COVID-19 patients, mortality is clearly increased (25% in our study) and is directly linked to severity of COVID-19 infection and comorbidities.

Table 1. Baseline And Procedural Characteristics.

Age	64.1±11.67 years
Gender Males Females	 9(75%) 3(25%)
Comorbidities HTN	 6(50%)
Diabetes mellits	4(33%)
CAD	1(8%)

Ejection fraction	56±13.2%
Blood indices	
Elevated Troponin	2(17%)
WBC count	9.35x10*3(SD=3.3x10*3)
Neutrophil(%)	78.2±20%
Lymphocyte count(%)	12.7±6.5%
Hemoglobin(g%)	12.6±3.3 g%)
Platelet count	110.4x10*3(SD=34.5x10*3)
Biochemical parameters	
LDH	347±128 U/L
D-Dimer	561±153 ng/ml
IL-6	33.62±8.3 pg/ml
Sr. Ferritin	559.5±177 ng/ml
Procedural chracteristics	
Single chamber PPM(no.)	5
Dual chamber PPM(no.)	4
Route /Puncture	Cephalic venous puncture=7 Axillary venous puncture=2

DISCUSSION

It is known that SARS-CoV enters into human cells via Angiotensin-Converting Enzyme 2 (ACE-2) receptors which are found in alveolar epithelial cells and endothelium of arteries and veins. Multiple hypotheses have been made to explain the mechanism of heart blocks in COVID-19 infection. In autopsy studies, SARS-CoV-2 virus and inflammatory infiltrate have been found in the myocardium, which implies direct viral invasion of the heart. ACE-2 downregulation decreases the action of angiotensin[1–8] leading to increased synthesis of inflammatory mediators like TNFα, CRP, and TGFβ which produces a cytokine storm. Troponin elevation and contractility dysfunction occur in the setting of severe hypoxia due to inflammatory damage or hypercoagulability. These phenomena initiated by the virus can occur in parallel with direct viral damage and interact with each other, enhancing their effect.[9] In our study, 2 patients were suspected of myocarditis. However, none were confirmed with MRI or cardiac biopsy. Kir et al. reported one patient with no evidence of myocardial involvement indicated by normal levels of cardiac enzymes and no findings on ECG, who developed a self-resolving 3rd-degree heart block. It is postulated that COVID-19 triggered subclinical myocarditis may have given rise to high-degree AV block in this patient.[15] The mechanism of heart block in other cases is poorly understood. Another plausible explanation is direct involvement of the AV node by SARS-CoV-2 as studies in animal models have shown to the presence of ACE2 receptors throughout the conduction system.[12-14] Ours is the largest single centre study with followup of two years. There was a tendecy for single chamber PPM implantation, (in 5 patients).In our study, all the patients who died after developing heart block were on noninvasive mechanical ventilation in the intensive care unit. They had MODS and shock. Death seems more linked to severity of COVID rather than heart block as both the patient's were on temporary pacemaker support. Deterioration of any pre-existing diseases in the conduction system such as AV node disease, bundle branch blocks, or His-Purkinje system disorder can cause new advanced blocks, leading to poor clinical outcomes.[16] Another big role in COVID-19 progression is played by comorbidities and risk factors. Cardiovascular diseases, hypertension, diabetes mellitus, renal disease, liver disease, cerebrovascular disease, obesity, hyperlipidemia, and smoking history have a crucial impact on disease progression and complications.[8] In our study, hypertension and diabetes mellitus were present in the majority of patients. Since many of these risk factors are modifiable, lifestyle changes, early diagnosis, and management of comorbidities must be considered for better outcomes in COVID-19 patients. Pathophysiological, histological, and imaging data [9,17] indicate that SARS-CoV-2 could induce tissue damage, which would predispose patients to recurrent cardiac issues long-term after discharge. However, the long-term impact of COVID-19 on heart blocks on late cardiac manifestations are not well studied, thus leading to poor clinical guidance regarding remote cardiac follow-up after discharge. In our study all nine patients are doimg well on followup after two years, with quality of life no different from those without COVID-19 infection. Another important observation which needs to be studied on a larger scale was the presence of severe lymphopenia(less than 50% of expected) in all the three patients who died.

LIMITATIONS

One of the limitations of our study was the restricted size of the sample population. Future reports of heart block in COVID-19 patients might reveal new relations between the severity of the infection and the prognosis of patients who develop heart block. Also, the presence of COVID-19 induced myocarditis was not confirmed via biopsy or MRI in any of the patients who developed heart block, reflecting a more conservative approach in the presence of COVID-19 infection.

CONCLUSIONS

The exact pathogenesis of heart block in COVID-19 patients must be further explored. More research is required to determine whether myocarditis due to COVID-19 is associated with the development of heart blocks. Our study showed COVID-19 an independent risk factor for worse prognosis in CHB. Patients hospitalized for COVID-19 must be continuously monitored for arrhythmias including heart blocks, especially in the presence of comorbdities. Physicians must be made aware of these cardiac manifestations of the infection, as early detection can improve the prognosis of the patient and shorten the hospital stay.

TAKE HOME MESSAGE

COVID-19 might affect the conduction system of the heart as part of its disease process.

Future studies are needed to address the mechanism of COVID-19 affects on the conduction system to improve the recognition of this phenomenon.

It is pertinent to recognize any metabolic and pharmacological risk factors related to conduction block in patients with COVID-19, and to provide close monitoring to high-risk patients in order to recognize this rare complication and treat it early on.

LIST OF ABBREVIATIONS USED

SARS(SEVERE ACUTE RESPIRATORY SYNDROME), CHB(COMPLETE HEART BLOCK), MODS(MULTIORGAN DYSFUNCTION SYNDROME), PPM(PERMANENT PACE MAKER)

REFERENCES:

1. 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;323(11):1061-1069. doi:10.1001/jama.2020.1585
2. Gupta A, Madhavan MV, Sehgal K, et al. Extrapulmonary manifestations of COVID-19. Nat Med. 2020;26(7):1017-1032. doi:10.1038/s41591-020-0968-
3. Hassan N et al. COVID-19 infection during pregnancy- Maternal and Perinatal outcomes International Journal Of Reproduction, Contraception, Obstetrics And Gynecology, Vol 9, No 9 (2020), doi.org/10.18203/2320-1770.ijrcog20203853
4. Sabatino J, Rosa SD, Salvo GD, Indolfi C. Impact of cardiovascular risk profile on COVID19 outcome. A meta-analysis. PLOS ONE. 2020;15(8):e0237131. doi:10.1371/journal.pone.0237131
5. Creel-Bulos C, Hockstein M, Amin N, Melhem S, Truong A, Sharifpour M. Acute Cor Pulmonale in Critically Ill Patients with Covid-19. N Engl J Med. 2020;382(21):e70. doi:10.1056/NEJMc2010459
6. Inciardi RM, Lupi L, Zaccone G, et al. Cardiac Involvement in a Patient With Coronavirus Disease 2019 (COVID-19). JAMA Cardiol. 2020;5(7):819-824. doi:10.1001/jamacardio.2020.1096
7. Singh S, Desai R, Gandhi Z, et al. Takotsubo Syndrome in Patients with COVID-19: a Systematic Review of Published Cases. SN Compr Clin Med. Published online October 6, 2020:1-7. doi:10.1007/s42399-020-00557
8. Hua A, O'Gallagher K, Sado D, Byrne J. Life-threatening cardiac tamponade complicating myo-pericarditis in COVID-19. Eur Heart J. 2020;41(22):2130. doi:10.1093/eurheartj/ehaa253
9. Babapoor-Farrokhran S, Gill D, Walker J, Rasekhi RT, Bozorgnia B, Amanullah A. Myocardial injury and COVID-19: Possible mechanisms. Life Sciences. 2020;253:117723. doi:10.1016/j.lfs.2020.117723
10. Malaty M, Kayes T, Amarasekera AT, Kodsi M, MacIntyre CR, Tan TC. Incidence and treatment of arrhythmias secondary to coronavirus infection in humans: A systematic review. Eur J Clin Invest. 2021;51(2):e13428. doi:10.1111/eci.13428
11. Garcia-Zamora S, Lee S, Haseeb S, et al. Arrhythmias and electrocardiographic findings in Coronavirus disease 2019: A systematic review and meta-analysis. Pacing and Clinical Electrophysiology. 2021;44(6):1062-1074. doi:10.1111/pace.14247
12. Inciardi RM, Lupi L, Zaccone G, Italia L, Raffo M, et al. (2020) Cardiac Involvement in a patient with coronavirus disease 2019 (COVID-19). JAMA Cardiol 5: 819-824.
13. Huang C, Wang Y, Li X, Ren L, Zhao J, et al. (2020) Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 395: 497-506.
14. Saito K, JS Gutkind, JM Saavedra (1987) Angiotensin II binding sites in the conduction system of rat hearts. American Journal of Physiology-Heart and Circulatory Physiology 253: H1618-H1622.
15. Kir D, Mohan C, Sancassani R. Heart Brake: An Unusual Cardiac Manifestation of COVID-19. JACC Case Rep. 2020;2(9):1252-1255. doi:10.1016/j.jaccas.2020.04.026
16. Hosseini Z, Ghodsi S, Hejazi SF. Persistent Complete Heart Block in a Patient with COVID-19 Infection: a Case Report. SN Compr Clin Med. Published online January 6, 2021:1-4. doi:10.1007/s42399-020-00712-3
17. Liu PP, Blet A, Smyth D, Li H. The Science Underlying COVID-19: Implications for the Cardiovascular System. Circulation. 2020;142(1):68-78. doi:10.1161/CIRCULATIONAHA.120.047549