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Bradycardias in patients with COVID-19: A case series



A B S T R A C T

Novel coronavirus disease (COVID-19) can have variety of cardiac manifestations; however, less is known about the prevalence, clinical characteristics and outcomes of bradycardias in patients with COVID-19. In the present case series of bradycardia in patients with COVID-19, we report complete heart block requiring intervention in 5 patients and sinus node dysfunction in 2 patients.

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Several cardiovascular complications of Coronavirus disease 2019 (COVID-19) including myocardial infarction, myocarditis, stroke, tachyarrhythmias and pulmonary embolism have been reported during the current pandemic. However, less is known about the prevalence, clinical characteristics and outcomes of bradycardias in patients with COVID-19 [1].

We report a case series of 7 patients with COVID-19 who presented with bradycardias. Of them, 5 had complete heart block and 2 had sick sinus syndrome. The clinical characteristics of the patients are summarized in Table 1. The patients were aged between 45 and 80 years. Out of these 3 were women. 2 patients had history of diabetes mellitus, hypertension, or myocardial infarction and 1 had a history of heart failure. None of the patients were on calcium channel blockers, beta-blockers, digoxin or antiarrhythmic drugs at baseline. In addition, hydroxychloroquine, azithromycin, zinc, remdesivir or convalescent plasma was not given to any of the patients for treatment of COVID-19.

All of the seven patients presented within 24–48 hours of symptom onset. Of these, 5 presented with recent onset syncope and 2 with presyncope. However, only 2 patients had history of fever. All patients were hemodynamically stable and none had hypoxia. Laboratory evaluation demonstrated lymphopenia in all patients and 1 had leucocytosis. High-sensitivity Troponin T levels were mildly elevated in 1 patient and N-terminal-pro hormone BNP (NT-proBNP) levels were elevated in 4 patients. High-sensitivity C-reactive protein (hs-CRP) was elevated in all patients except one and 4 patients had elevated levels of ferritin. Chest X-ray showed infiltrates in five patients. All the patients had bradycardia with a maximum heart-rate of 42 bpm. The escape rhythm was ventricular in 4 out of 5 patients with complete heart block and rest of the patients had junctional escape rhythm. Transthoracic echocardiogram showed preserved left ventricular ejection fraction (LVEF) in 5 patients, while 2 had LVEF \leq 50%. In view of symptomatic bradycardia and the uncertainty of clinical course of COVID-19, these patients

received emergent temporary transvenous pacing. All these patients were strictly monitored for reversion of sinus rhythm, requirement of back up pacing and ventricular arrhythmias for 10–14 days. Five patients with pacing dependent and symptomatic complete heart block, underwent dual-chamber permanent pacemaker implantations approximately 2 weeks after the presentation, with the use of personal protective equipment as per the guidelines of our institution. Two patients with sick sinus syndrome patients were kept under medical follow-up.

COVID-19 has been associated with development of cardiac dysfunction in patients with or without underlying cardiac condition [1]. In this largest case series of bradycardia in patients with COVID-19, we report complete heart block requiring intervention in 5 patients and sinus node dysfunction in 2 patients. There have been few isolated reports of development of clinically significant bradycardia in few patients with COVID-19 [2,3]. A recent publication reported sinus node dysfunction in 2 patients with COVID-19, both of whom remained in sinus bradycardia after discharge. Another publication reported a solitary case of transient complete heart block in a critically ill patient who died from pulmonary complications of COVID-19 [2,3]. In present series, none of the patient had any reversible cause of complete heart block.

A definitive mechanism for the development of bradycardia in patients with COVID-19 has not been established yet. Furthermore, it is not known if the virus for COVID-19 has any affinity for the receptors in the myocardial conduction system. As myocarditis has been reported in many patients with COVID-19, it is plausible that myocardial inflammation and injury may affect the conduction system resulting in complete heart block [4]. Autopsies of patients who died secondary to COVID-19 have showed the presence of viral RNA in cardiac myocytes and endothelial cells suggesting direct involvement of the myocardium in this disease. The COVID-19 virus may enter the cardiac myocytes via angiotensin-converting enzyme 2 (ACE2) receptor resulting in myocardial inflammation and injury [5]. Cardiac Magnetic Resonance Imaging (MRI), a definite non-invasive test for myocarditis is currently unavailable at our medical centre due to the COVID-19 pandemic. However, since only 1 patient in our case series had

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Abbreviations and Acronyms: COVID-19, Coronavirus disease 2019.

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Table 1
Characteristics of COVID-19 patients with bradyarrhythmias.

Characteristics	Pt. 1	Pt. 2	Pt. 3	Pt. 4	Pt. 5	Pt. 6	Pt. 7
Age, years	55	56	67	80	45	55	69
Sex	Female	Female	Male	Male	Female	Male	Male
Medical History							
Diabetes Mellitus	Yes	No	Yes	No	No	No	No
Hypertension	No	No	Yes	Yes	No	No	No
Prior Myocardial Infarction	No	No	No	Yes	No	Yes	No
Prior Heart Failure	No	No	No	No	No	No	Yes
Clinical Presentation							
Syncope	Yes	Yes	Yes	Yes	Yes	No	No
Fever	No	Yes	Yes	No	No	No	No
Cough	No	No	Yes	No	No	No	No
Dyspnea	No	No	Yes	Yes	No	No	No
Heart rate (bpm)	40	32	30	42	36	33	40
Escape rhythm	Ventricular	Ventricular	Ventricular	Ventricular	Junctional	Junctional	Junctional
Systolic Blood Pressure (mmHg)	120	100	110	200	130	90	116
Diastolic Blood Pressure (mmHg)	60	60	70	110	80	60	76
Oxygen Saturation	98	97	98	98	98	99	98
Laboratory/Imaging Evaluation							
White blood count (cells/mm ³)	11,800	11,200	7400	8100	5200	17,300	8400
Neutrophil/Lymphocyte ratio	75/20	75/22	76/22	63/19	65/27	84/11	71/12
Serum Creatinine (mg/dL)	0.6	0.6	1.4	0.8	0.6	1.5	1.3
Serum Na mmol/litre)	138	136	104	136	138	143	134
Serum K (mmol/litre)	4.7	3.4	4.2	5.1	4.0	4.8	3.9
High-sensitive Troponin T (Upper limit of normal <0.014)	0.011	0.003	0.014	0.006	0.007	0.018	ND
NT Pro BNP (pg/ml)	157	143.5	3814	1515	2206	677.4	ND
hsCRP (mg/litre)	57.1	48.38	81.72	106.7	395.83	74.25	ND
Ferritin (ng/ml)	80.5	280	327	460	520	81.4	ND
Infiltrates on Chest-X ray	Absent	Unilateral	Bilateral	Bilateral	Bilateral	Absent	Bilateral
LVEF (%)	60	60	60	50	60	60	40
Bradyarrhythmia	CHB	CHB	CHB	CHB	SSS	CHB	SSS
Time from presentation to pacemaker implantation	14 days	12 days	12 days	15 days	ND	17 days	ND

CHB: complete heart block, SSS: sick sinus syndrome, ND: Not done, Pt.: Patient.

an elevated high-sensitive troponin T, a marker of myocardial injury, we expect that the majority of these patients did not have myocarditis.

In conclusion, patients with COVID-19 may be observed for possible bradyarrhythmias. While, there is no definitive evidence of causality.

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Declaration of competing interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ipej.2020.08.004>.

References

- [1] Fried JA, Ramasubbu K, Bhatt R, et al. The variety of cardiovascular presentations of COVID-19. *Circulation* 2020;141(23):1930–6. <https://doi.org/10.1161/CIRCULATIONAHA.120.047164>.
- [2] Peigh G, Leya MV, Baman JR, Cantey EP, Knight BP, Flaherty JD. Novel

coronavirus 19 (COVID-19) associated sinus node dysfunction: a case series. *Eur Heart J Case Rep* 2020. <https://doi.org/10.1093/ehjcr/ytaa132>. ytaa132, . [Accessed 8 May 2020].

- [3] Azarkish M, Laleh Far V, Eslami M, Mollazadeh R. Transient complete heart block in a patient with critical COVID-19. *Eur Heart J* 2020;41(22):2131. <https://doi.org/10.1093/eurheartj/ehaa307>.
- [4] Driggin E, Madhavan MV, Bikdeli B, et al. Cardiovascular considerations for patients, health care workers, and health systems during the COVID-19 pandemic. *J Am Coll Cardiol* 2020;75(18):2352–71. <https://doi.org/10.1016/j.jacc.2020.03.031>.
- [5] Oudit GY, Kassiri Z, Jiang C, et al. SARS-coronavirus modulation of myocardial ACE2 expression and inflammation in patients with SARS. *Eur J Clin Invest* 2009;39(7):618–25. <https://doi.org/10.1111/j.1365-2362.2009.02153.x>.

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