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Case Report

Complete Atrioventricular Block in COVID-19–Related Myocarditis: A Case Report

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ABSTRACT

Myocarditis accompanied by a high-grade atrioventricular (AV) block is a rare manifestation of COVID-19 infection. A 53-year-old woman presented with an episode of syncope, dyspnea, dry cough, and fever. On physical examination, the patient had high blood pressure and bradycardia. Her electrocardiography displayed a complete AV block with a junctional escape rhythm. Laboratory investigations revealed leukocytosis, elevated D-dimer, a positive SARS-CoV-2 nasopharyngeal swab, and a significant elevation in troponin. No reversible cause of the AV block was found, and the complete AV block persisted after the complete treatment of COVID-19. A His bundle permanent pacemaker was then implanted. An endomyocardial biopsy demonstrated endomyocardial tissue with focal hemorrhage, fatty infiltration in the endocardium, and active chronic inflammation, supporting the diagnosis of myocarditis. Several hypotheses of complete heart block in COVID-19 infection have been proposed, including direct myocardial injury and enhanced inflammatory response. A persistent total AV block following complete COVID-19 treatment is an indication for permanent pacemaker implantation. ***(Iranian Heart Journal 2023; 24(2): 108-113)***

KEYWORDS: COVID-19, Myocarditis, complete heart block, Case report

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The coronavirus outbreak started in late 2019 in Wuhan, China. Over a short time, it turned into a striking pandemic. [1] Coronavirus disease 2019 (COVID-19) due to severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is primarily a respiratory disease, but systemic and cardiovascular involvement can occur. [2] Potential cardiac involvement by SARS-CoV-2 as indicated by dysrhythmias and acute heart failure with reduced ejection fraction has been reported. [3] Myocardial involvement with the novel coronavirus, ranging from mild troponin leak to fulminant myocarditis, is well reported in adults and occurs in 8% to 28% of adults infected with SARS-COV-2. [4] However, clinical characteristics and outcomes of bradyarrhythmias in this pandemic are less investigated. [5]

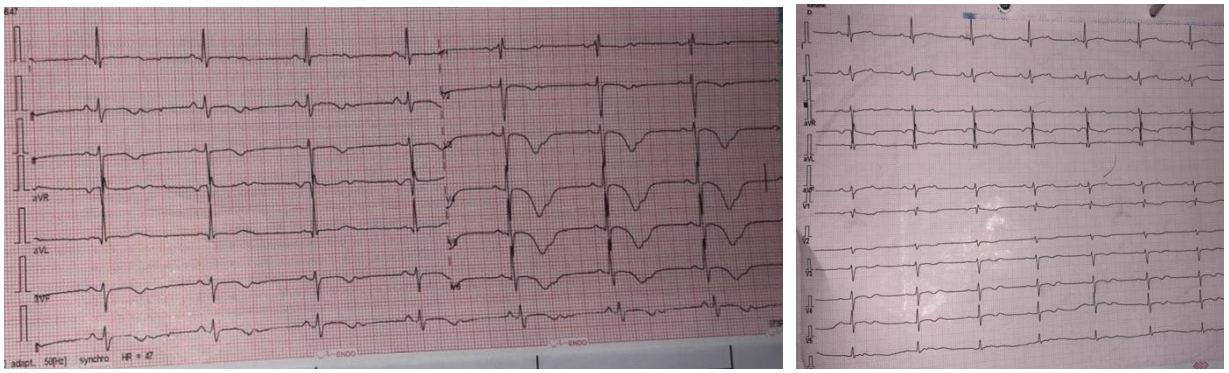
A few cases of concurrent myocarditis have been reported. Still, the extent of cardiac complications with the SARS-CoV-2 strain of coronavirus is largely unknown. [6] The hypothesis that SARS-CoV-2 causes viral myocarditis or serves as a trigger event for immune-mediated myocarditis in selected susceptible patients is possible but should be definitively proven. So far, myocarditis is an uncommon complication in SARS-CoV-2 infection, and no data still exist on

endomyocardial biopsy (EMB) or autopsy-proven myocarditis caused by this novel coronavirus. The term "myocarditis" as referring only to EMB or autopsy-proven diagnosis according to the European Society of Cardiology (ESC) criteria should be encouraged. [7]

Case Report

A 52-year-old woman presented to our hospital with an episode of syncope, followed by general weakness, 2 days before admission. The patient had never experienced such symptoms. She also reported non-productive coughs and shortness of breath on minimal exertion for 5 days prior to admission, preceded by fever for 1 week. This patient had a history of uncontrolled hypertension of a 1-month duration. She was fully conscious on admission, with a blood pressure of 160/90 mm Hg and a heart rate of 48 beats per minute. Other physical findings were within normal limits. Electrocardiography (ECG) (Fig. 1a) showed a complete atrioventricular (AV) block with a junctional escape rhythm (50 bpm). Significant laboratory findings revealed leukocytosis with a white blood cell count of 12.400/mm^3, a neutrophil-to-lymphocyte ratio (NLR) ratio of 7.2, and a D-dimer level of 1.2 µg/mL. The thyroid function and electrolytes were normal. Multislice computed tomography thorax indicated cardiomegaly with a normal lung appearance. A polymerase chain reaction (PCR) SARS-CoV-2 nasopharyngeal swab was collected, and the result was positive. The patient was treated for a total AV block with stable hemodynamics, probably due to COVID-19–related myocarditis. The clinical suspicion of myocarditis in this patient was supported by a high-sensitivity cardiac troponin increment (1161.6 ng/L).

The patient was then admitted to the isolation ward and treated for 7 days until a negative confirmation of COVID-19 by another PCR SARS-CoV-2 nasopharyngeal swab. However, ECG (Fig. 1b) showed a persistent complete AV block with a junctional escape rhythm. Coronary artery disease was excluded through coronary angiography (Fig. 2), which showed insignificant stenosis in the left main and the left anterior descending. A VVI-mode His bundle permanent pacemaker (PPM) was implanted while doing an EMB to confirm the diagnosis of COVID-19–related myocarditis. ECG (Fig. 3) after a successful PPM implantation procedure showed a pacing rhythm with a ventricular capture rhythm of 60 beats per minute. A histopathological examination (Fig. 4) of the EMB demonstrated endomyocardial tissue with focal hemorrhage, fatty infiltration in the endocardium, and active chronic inflammation.



Figures 1a and 1b: On admission, the patient's electrocardiogram shows a complete atrioventricular block with a junctional escape rhythm of 50 beats per minute (1a). One week following treatment for COVID-19 and the conversion of the nasopharyngeal swab to negative, the electrocardiogram displays a persistent complete heart block.

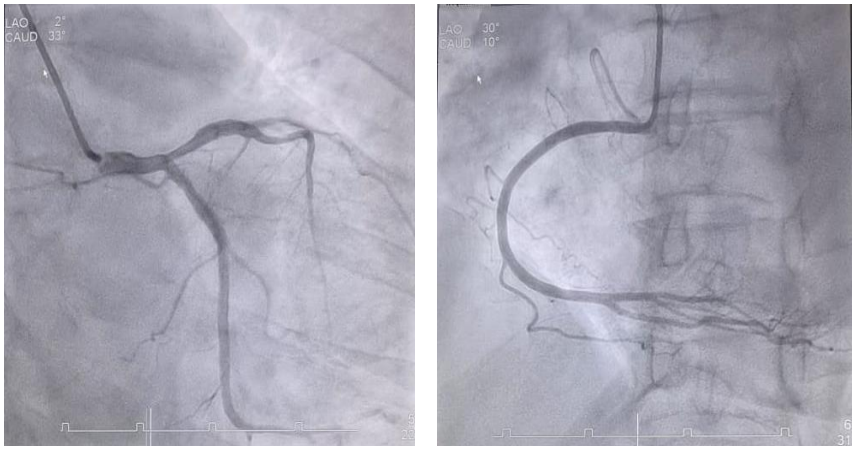


Figure 2: Coronary angiography demonstrates insignificant stenosis in the left main and the left anterior descending arteries.

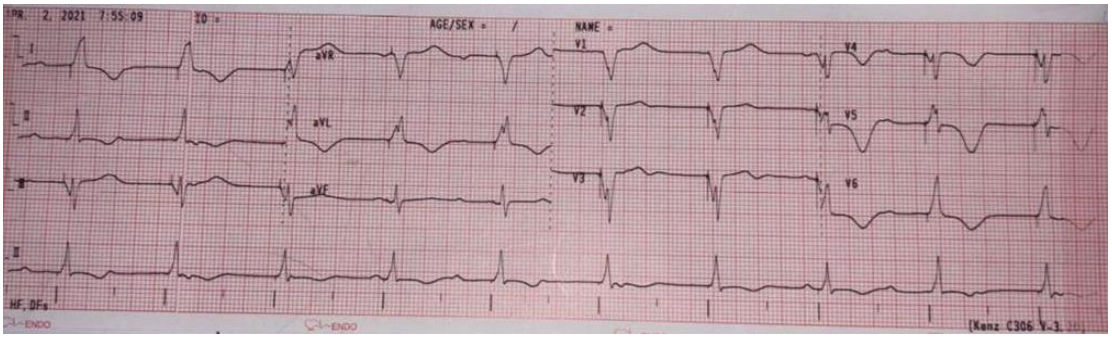


Figure 3: The electrocardiogram after successful permanent pacemaker implantation shows a pacing rhythm with a ventricular capture of 60 beats per minute.

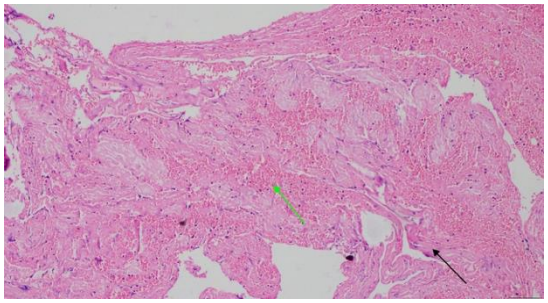


Figure 4a: Green arrow: hemorrhage, **Black arrow:** myocardial cells

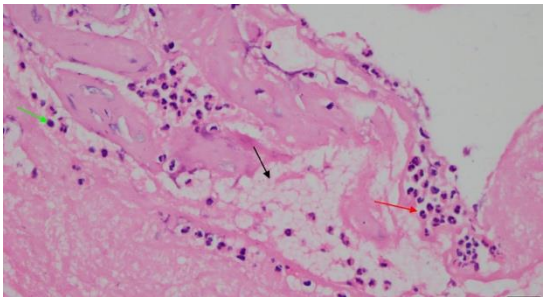


Figure 4b: Green arrow: infiltration of lymphocyte cells; **Black arrow:** vacuoles of lipid droplet; **Red Arrow:** infiltration of neutrophil cells

Figures 4a and 4b: The histopathological examination of endomyocardial biopsy shows endomyocardial tissue with focal hemorrhage, fatty infiltration in the endocardium, and active chronic inflammation.

DISCUSSION

Although respiratory failure is the primary complication seen in COVID-19, patients are at high risk of having multisystem involvement, including acute cardiac injury. Cardiac involvement with COVID-19 has ranged from asymptomatic myocardial injury to acute coronary syndrome, myocarditis, stress cardiomyopathy, and cardiogenic shock. [8]

Arrhythmias can often be the first presenting feature of myocarditis. Acute and chronic myocarditis is considered to be among the most significant causes of advanced AV block in young and middle-aged patients. [9] A definitive mechanism for the development of bradyarrhythmia in patients with COVID-19 has not been established yet. However, several pathomechanisms have been proposed. The hypothesis that developed in describing the potential mechanism of cardiac arrhythmias, including direct myocardial injury, hypoxia, hypotension, enhanced inflammatory response, angiotensin-converting enzyme-2 (ACE-2) receptor downregulation,[10,11] and indicators of the proinflammatory state (eg, IL-6 and D-dimer levels), are thought to be part of systemic inflammation and contributors to the cardiac manifestation of COVID-19. [12,13] No reversible causes of AV block were identified in the patient, including thyroid dysfunction, electrolyte disturbances, acute myocardial infarction, or use of medications such as chloroquine and/or hydroxychloroquine, which are commonly prescribed to treat COVID-19 infection.

According to the ESC guideline, PPM implantation in a patient with complete AV block associated with COVID-19 should be implemented until the patient is afebrile for more than 24 hours. [14] A permanent pacemaker was implanted after ECG showed a persistent complete heart block despite a negative confirmation of COVID-19 through a nasopharyngeal swab examination, following a 1-week treatment course in the isolation ward.

Myocarditis is an inflammatory disease of the heart that often poses a diagnostic challenge due to the heterogeneity of presentation and a wide range of etiologies. Additionally, the actual incidence of myocarditis is difficult to estimate as a tissue diagnosis with an EMB is rarely obtained despite it being the gold standard for diagnosis. [6] The guidelines of the American College of Cardiology state that EMB should be performed in the setting of new-onset heart failure with hemodynamic compromise or new ventricular arrhythmias (Class I recommendation); nonetheless, the timing and exact criteria for EMB in cases of myocarditis, especially in the setting of COVID-19 infection, remain uncertain. [15] An EMB was performed on the patient, and a PPM was implanted to reduce the risk of cardiac perforation and prolonged radiation. Several publications have reported inflammatory cell infiltration and myocardial necrosis from EMB histopathological findings. [16,17] The patient's EMB histopathological examination showed active chronic inflammation with lymphocyte and neutrophil infiltration to the myocardium.

CONCLUSIONS

There have been a number of reports of individuals with COVID-19 experiencing complete heart blocks. PPM implantation is not routinely performed in COVID-19–related complete heart block due to its possibility of reversible mechanism. The persistent complete AV block following comprehensive COVID-19 treatment is indicated for PPM implantation. EMB remains a gold standard to confirm myocarditis, although it is still rarely performed. Histopathological findings from EMB in COVID-19–related myocarditis generally show signs of inflammation with lymphocyte infiltration to the myocardium, similar to findings in our patient.

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Ethical Approval: The institutional ethics committee clearance was obtained for the study.

Informed Consent: Written informed consent was taken for the procedures involved and for the publication of anonymized data.

Consent for Publication: Consent for publication was obtained from the patient for the publication of anonymized data.

Data Availability: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available because they contain information that could compromise the privacy of the research participant.

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REFERENCES

1. Hosseini Z, Ghodsi S, Hejazi SF. Persistent Complete Heart Block in a Patient with COVID-19 Infection: a Case Report. SN Compr Clin Med. 2021; 3(1):259–62.

2. Basso C, Leone O, Rizzo S, De Gaspari M, Van Der Wal AC, Aubry MC, et al. Pathological features of COVID-19-associated myocardial injury: A multicentre cardiovascular pathology study. Eur Heart J. 2020; 41(39):3827–35.

3. Bearse M, Hung YP, Krauson AJ, Bonanno L, Boyraz B, Harris CK, et al. Factors associated with myocardial SARS-CoV-2 infection, myocarditis, and cardiac inflammation in patients with COVID-19. Mod Pathol. 2021;

4. El-Assaad I, Hood-Pishchany MI, Kheir J, Mistry K, Dixit A, Halyabar O, et al. Complete Heart Block, Severe Ventricular Dysfunction, and Myocardial Inflammation in a Child With COVID-19 Infection. JACC Case Reports. 2020; 2(9):1351–5.

5. Fried JA, Ramasubbu K, Bhatt R, Topkara VK, Clerkin KJ, Horn E, et al. The Variety of Cardiovascular Presentations of COVID-19. Circulation. 2020; 141(23):1930–6.

6. Ashok V, Loke WI, Dinov B, Robert S, David N, Camm CF, et al. Case report: High-grade atrioventricular block in suspected COVID-19 myocarditis. Eur Heart J - Case Reports. 2020; 4(FI1).

7. Ozieranski K, Tyminska A, Jonik S, Marcolongo R, Baritussio A, Grabowski M, et al. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID- 19. The COVID-19 resource centre is hosted on Elsevier Connect , the company ' s public news and information website . Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories , such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source . These permissions are Clinically Suspected Myocarditis in the Course of Severe Acute Respiratory Syndrome Novel Coronavirus-2 Infection : Fact or Fiction ? 2020; (January).

8. Al-Assaf O, Mirza M, Musa A. Atypical presentation of COVID-19 as subclinical myocarditis with persistent high-degree atrioventricular block treated with pacemaker implant. Hear Case Reports [Internet]. 2020; 6(11):884–7. Available from: https://doi.org/10.1016/j.hrcr.2020.09.003

9. Barra SNC, Providência R, Paiva L, Nascimento J, Marques AL. A review on

advanced atrioventricular block in young or middle-aged adults. PACE - Pacing Clin Electrophysiol. 2012; 35(11):1395–405.

10. Gulizia MM, Zecchin M, Colivicchi F, Francese GM, Morrone A, Caldarola P, et al. ANMCO position paper: The management of suspect or confirmed COVID-19 patients needing urgent electrophysiology and/or electrostimulation procedures. Eur Heart Journal, Suppl. 2020; 22:G211–6.

11. Kochav SM, Coromilas E, Nalbandian A, Ranard LS, Gupta A, Chung MK, et al. Cardiac Arrhythmias in COVID-19 Infection. Circ Arrhythmia Electrophysiol. 2020; (June):579–85.

12. Blomström-Lundqvist C, Traykov V, Erba PA, Burri H, Nielsen JC, Bongiorni MG, et al. European Heart Rhythm Association (EHRA) international consensus document on how to prevent, diagnose, and treat cardiac implantable electronic device infections - Endorsed by the Heart Rhythm Society (HRS), the Asia Pacific Heart Rhythm Society (APHRS), the Latin American Heart Rhythm Society (LAHRS), International Society for Cardiovascular Infectious Diseases (ISCVID) and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) in collaboration with the European Association for Cardio-Thoracic Surgery (EACTS). Europace. 2020; 22(4):515–6.

13. Liu PP, Blet A, Smyth D, Li H. The Science Underlying COVID-19: Implications for the Cardiovascular System. Circulation. 2020; 2019:68–78.

14. Amaratunga EA, Corwin DS, Moran L, Snyder R. Bradycardia in Patients With COVID-19: A Calm Before the Storm? Cureus. 2020; 2(6):6–13.

15. Cooper LT, Baughman KL, Feldman AM, Frustaci A, Jessup M, Kuhl U, et al. The role of endomyocardial biopsy in the management of cardiovascular disease: a scientific statement from the American Heart Association, the American College of Cardiology, and the European Society of Cardiology. Endorsed by the Heart Failure Society of America and the Heart Failure Association of the European Society of Cardiology. J Am Coll Cardiol. 2007 Nov; 50(19):1914–31.

16. Basso C, Leone O, Rizzo S, De Gaspari M, van der Wal AC, Aubry M-C, et al. Pathological features of COVID-19-associated myocardial injury: a multicentre cardiovascular pathology study. Eur Heart J [Internet]. 2020; 41(39):3827–35. Available from: https://doi.org/10.1093/eurheartj/ehaa664

17. Kawakami R, Sakamoto A, Kawai K, Gianatti A, Pellegrini D, Nasr A, et al. Pathological Evidence for SARS-CoV-2 as a Cause of Myocarditis:

18. JACC Review Topic of the Week. J Am Coll Cardiol. 2021 Jan; 77(3):314–25.