Case study

A Rare Case of Myocarditis Causing Interventricular Communication and Acute Heart Failure

Abstract:

Myocarditis is a rare but potentially life-threatening condition that involves inflammation of the heart muscle. It can present with a wide range of clinical manifestations, including acute heart failure, arrhythmias, and ventricular dysfunction. In rare cases, myocarditis can lead to the formation of interventricular communication, which is an abnormal communication between the left and right ventricles. We present a case report of a 31-year-old male who presented to the emergency department with acute heart failure and was subsequently diagnosed with myocarditis causing interventricular communication.

Keywords:

Myocarditis, Interventricular Communication, Heart Failure, Diagnosis, Management, Outcome

Introduction

Acute myocarditisis inflammation of the myocardium. It istypicallyseen in young patients but can occur at anyage. It mostcommonlyresultsfrom a viral illness but can alsobe due to non-infectiousetiologies. Givenits variable clinicalpresentation, the diagnosisisfrequentlymissed, makingitdifficult to quantify the true incidence and prevalence of the disease. Acute myocarditisconstitutesmost cases of myocarditis (65%) and ismainlycaused by a viral illness [15]. It maylesscommonlybecaused by non-infectiousetiologies. There can eitherbe a focal or diffuse involvement of the myocardium [16].

Case Presentation:

A 31-year-old male with no significant past medical history presented to the emergency department with a two-day history of progressive shortness of breath, atypical chest pain, and generalized weakness. On physical examination, he was tachypneic with bibasalbilateral crackles on lung auscultation and had elevated jugular venous pressure. His blood pressure was 90/60 mmHg, and heart rate was 110 beats per minute. Electrocardiogram showed sinus tachycardia with diffuse ST-segment elevations in the precordial leads. Cardiac enzymes were

elevated with troponin I level of 3.2 ng/mL (normal range <0.04 ng/mL) and an elevated brain natriuretic peptide (BNP) level of 900 pg/mL (reference range <100 pg/mL).Complete blood count, electrolytes, and renal function tests were within normal limits. The patient tested negative for common respiratory pathogens, including influenza A and B, respiratory syncytial virus, and SARS-CoV-2, ruling out an acute viral respiratory infection. Chest X-ray showed pulmonary congestion.

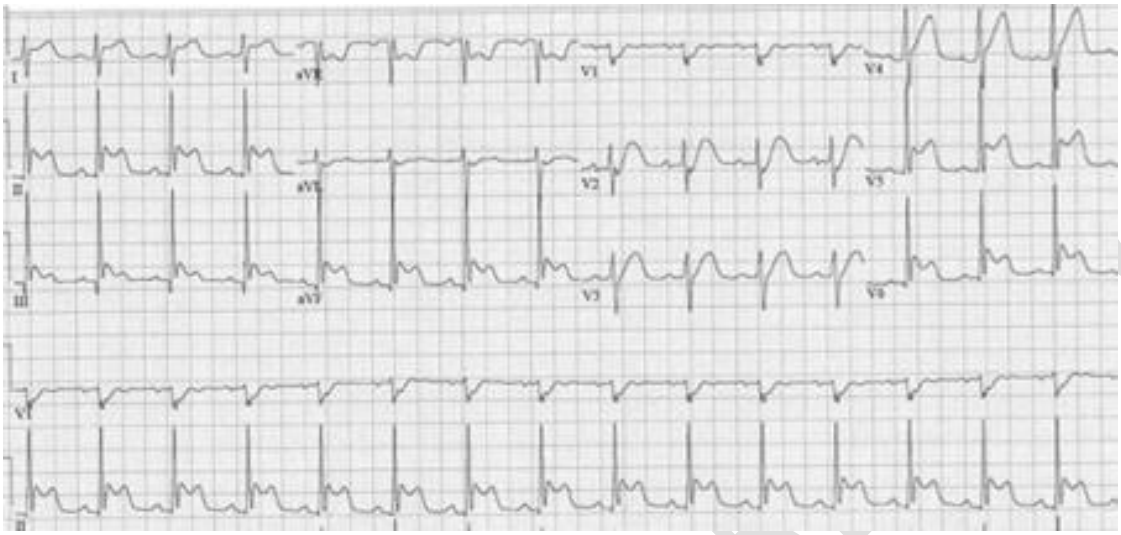

Figure 1: patient ECG showing sinus tachycardia with diffuse ST-segment elevations

The patient was admitted to the intensive care unit (ICU) with a diagnosis of acute heart failure, and intravenous diuretics and inotropic support were initiated. Transthoracic echocardiogram (TTE) showed hypokinetic left ventricle with severelyreduced ejection fraction (EF) of 20% and a small left-to-right shunt consistent with an interventricular communication. The filling pressure was also high.

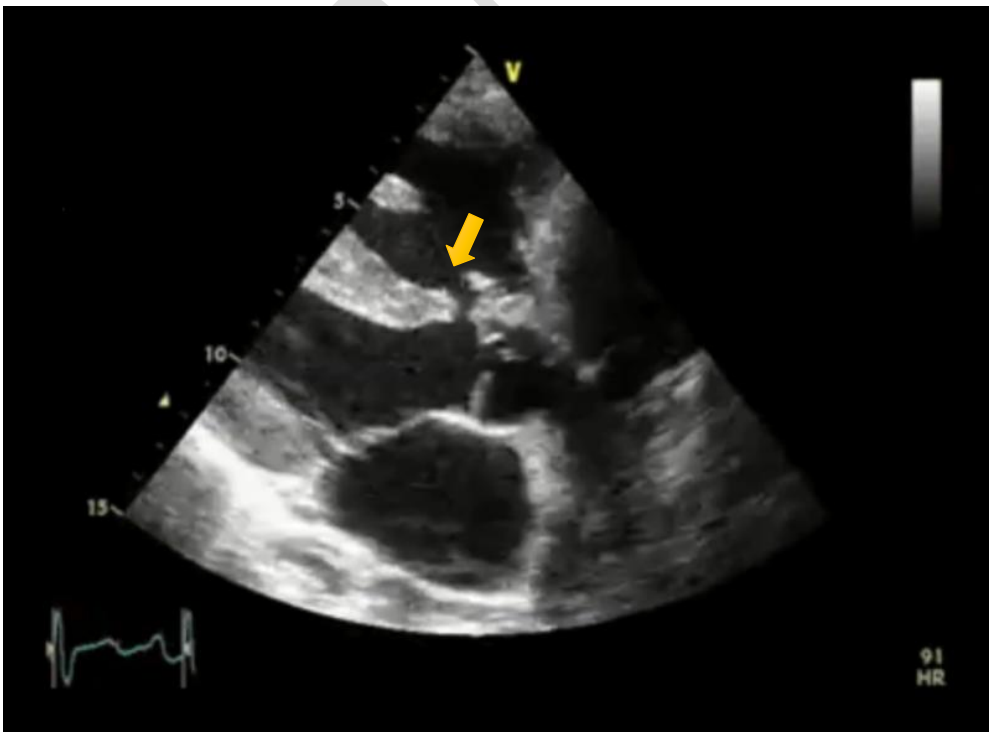

Figure 2: TTE of the patient showing a small interventricular communication

Coronary angiography was performed to exclude obstructive coronary artery disease as a potential cause of the patient's symptoms. The coronary arteries were found to be free of significant stenosis, confirming that myocarditis was the primary underlying pathology.

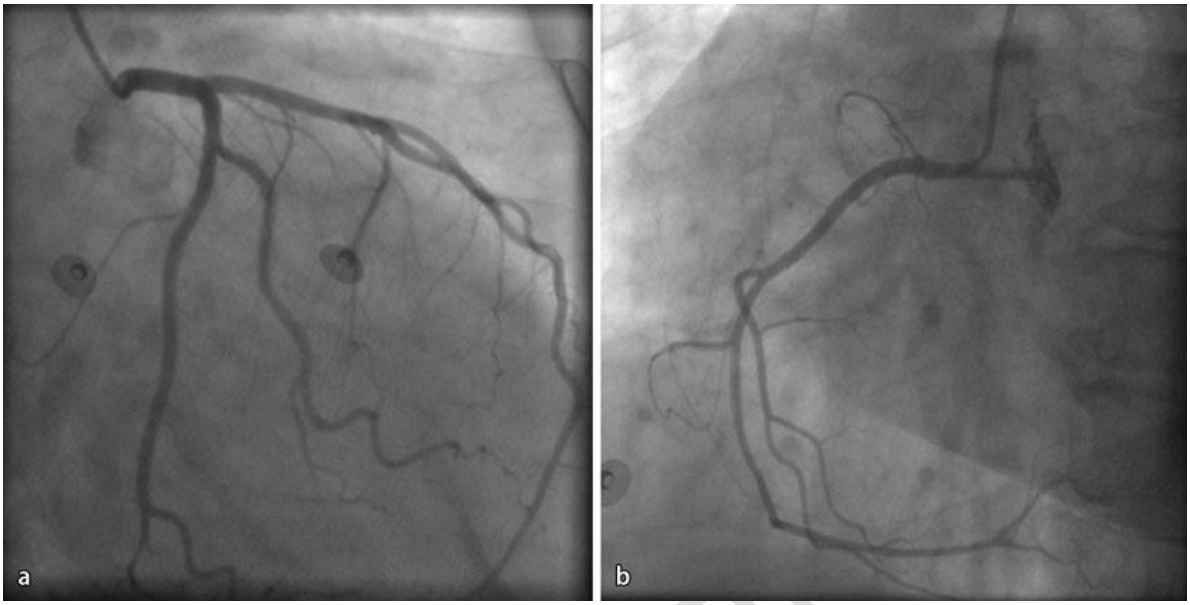

Figure 3: Coronary angiography of the patient is normal

Further workup, including blood cultures and serological tests for viral infections, was negative. However, cardiac magnetic resonance imaging (MRI) showed diffuse myocardial edema and late gadolinium enhancement consistent with acute myocarditis.

A diagnosis of myocarditis causing interventricular communication was made based on clinical presentation, TTE findings, and cardiac MRI findings.

Management and outcome:

The treatment approach aimed to address both the acute heart failure and the underlying myocarditis. Additionally, close monitoring was crucial throughout the patient's hospitalization.

- ✓ **Hemodynamic Support**: Given the patient's compromised hemodynamics, he was admitted to the intensive care unit (ICU) for continuous monitoring. Intravenous diuretics, such as furosemide, were administered to manage pulmonary congestion and alleviate symptoms of heart failure. Inotropic support with dobutamine was initiated to improve myocardial contractility and maintain adequate cardiac output.
- ✓ **Close Monitoring**: Continuous monitoring of the patient's vital signs, electrocardiogram (ECG), and hemodynamic parameters was maintained in the ICU. Frequent assessment of cardiac biomarkers, including troponin I and BNP, was performed to monitor myocardial injury and heart failure status.
- ✓ **Supportive Care**: The patient was provided with supportive care measures, including oxygen therapy to maintain adequate oxygen saturation and pain management as needed. Nutritional support was also initiated to meet the patient's metabolic demands and support recovery.

Throughout the hospitalization, the patient's clinical status gradually improved. He experienced a reduction in dyspnea, normalization of vital signs, and a decrease in cardiac biomarkers. Repeattransthoracicechocardiography TTE after two weeks showed improved left ventricular function with EF of 40%partial closure of the interventricular communication (IVC) as the myocardial inflammation subsided. Cardiac MRI was repeated to assess the resolution of myocardial edema and late gadolinium enhancement, which indicated a positive response to treatment.

After several days of intensive care and medical therapy, the patient was transitioned to a general cardiology ward for further monitoring and rehabilitation. He was discharged with guideline therapy for heart failure based on betablocker, angiotensin-converting enzyme inhibitor. Cardiac follow-up appointments were scheduled to assess the progression of myocardial recovery, EF improvement, and the status of the interventricular communication (IVC).

Long-term management for this patient involves ongoing surveillance, optimization of heart failure medications, and regular cardiac assessments to monitor cardiac function and any potential sequelae related to the resolved interventricular communication (IVC). The patient is educated on the importance of adherence to medication and lifestyle modifications, including diet and exercise, to reduce the risk of recurrent myocarditis or complications associated with heart failure.

Discussion:

Myocarditis is a complex and multifaceted condition with various etiologies, ranging from viral infections to autoimmune reactions, which can lead to a broad spectrum of clinical presentations, including chest pain, arrhythmias, and heart failure (1). While interventricular communication (IVC) is an exceedingly rare complication of myocarditis, its occurrence underscores the importance of early diagnosis and comprehensive management strategies (2).

The diagnostic journey in myocarditis can be challenging, with clinical, laboratory, and imaging findings often overlapping with other cardiac conditions. In our case, the patient initially presented with symptoms of acute heart failure, including dyspnea, fatigue, and tachycardia, which are common clinical manifestations of severe myocarditis (3). Elevated cardiac biomarkers, such as troponin I and BNP, served as initial indicators of myocardial injury and heart failure (4). These findings are consistent with prior reports of myocarditis-associated heart failure (5).

Imaging modalities played a pivotal role in the diagnosis and characterization of our patient's condition. Transthoracic echocardiography (TTE) revealed severe biventricular systolic dysfunction, a common finding in myocarditis (6). The identification of an IVC within the interventricular septum, initially seen on TTE and confirmed with transesophageal echocardiography (TEE), was a remarkable discovery. IVC, in the context of myocarditis, is an exceptionally rare occurrence, with only a few cases reported in the literature (7,8). The presence of this direct communication between the left and right ventricles contributes to the unique clinical presentation of acute heart failure (9).

Cardiac magnetic resonance imaging (MRI) provided further insights into the underlying myocardial pathology. It revealed marked myocardial edema and late gadolinium enhancement in the septal and apical segments of the left ventricle, which are characteristic features of myocarditis (10). MRI also aids in differentiating myocarditis from other causes of cardiomyopathy, such as ischemic heart disease (11).

Treatment in this case involved a multidisciplinary approach. The patient received intravenous diuretics and inotropes to manage acute heart failure symptoms (12). Medical treatment of heart failure with beta-blockers, diuretics, and angiotensin-converting enzyme inhibitors (ACEI) may sometimes be needed to aid in treating heart failure symptoms in patients with myocarditis and in severe cases like severe acute or fulminant in myocarditis, supportive intensive care can be used (14).

Long-term management will require ongoing surveillance and optimization of pharmacological therapy. Regular follow-up with imaging and clinical assessment is essential to monitor the resolution of the IVC and the recovery of myocardial function (13).

In conclusion, this case illustrates the challenges in diagnosing and managing a rare complication of myocarditis, interventricular communication, leading to acute heart failure. A combination of clinical evaluation, laboratory investigations, and advanced imaging techniques, such as TTE, TEE, and cardiac MRI, played a crucial role in achieving a precise diagnosis. Further research is warranted to better understand the pathophysiology of myocarditis-associated IVC and to establish evidence-based treatment guidelines for this rare but potentially life-threatening condition.

Conclusion:

Myocarditis can be a rare but serious cause of acute heart failure, and in rare cases, it can lead to the formation of interventricular communication. This case report highlights the importance of considering myocarditis as a potential etiology in patients presenting with acute heart failure, and the need for comprehensive imaging studies, such as TTE and cardiac MRI, to accurately diagnose and manage this condition. Prompt recognition and appropriate management of myocarditis can lead to favorable outcomes and prevent complications such as interventricular communication.

Abreviations:

List of all abbreviations used:

1. MD - Doctor of Medicine (Title for medical doctors)
2. ECG - Electrocardiography
3. BNP - Brain Natriuretic Peptide
4. TTE - Transthoracic Echocardiography

5. TEE - Transesophageal Echocardiography
6. IVC - Interventricular Communication
7. MRI - Magnetic Resonance Imaging
8. ICU - Intensive Care Unit
9. IVIG - Intravenous Immunoglobulin
10. ECG - Electrocardiogram
11. EF - Ejection Fraction

References:

1. Caforio, A. L. P., Pankuweit, S., Arbustini, E., Basso, C., Gimeno-Blanes, J., Felix, S. B., ... & Charron, P. (2013). Current state of knowledge on aetiology, diagnosis, management, and therapy of myocarditis: a position statement of the European Society of Cardiology Working Group on Myocardial and Pericardial Diseases. EuropeanHeart Journal, 34(33), 2636-2648.
2. Shabtaie, S. A., Garan, A. R., &Topkara, V. K. (2019). Interventricular Septal Defect. In Mechanical Circulatory Support (pp. 169-176). Springer.
3. Ammirati, E., Veronese, G., Brambatti, M., Merlo, M., Cipriani, M., Potena, L., ... & Caforio, A. L. P. (2018). Fulminant versus acute nonfulminant myocarditis in patients with left ventricular systolic dysfunction. Journal of the American College of Cardiology, 71(4), 386-395.
4. Bhardwaj, A., &Tanavde, V. (2020). Elevated B-type natriuretic peptide in acute myocarditis. Cardiology in the Young, 30(11), 1617-1619.
5. Aretz, H. T., Billingham, M. E., Edwards, W. D., Factor, S. M., Fallon, J. T., Fenoglio Jr, J. J., ... & Popp, R. L. (1987). Myocarditis: a histopathologic definition and classification. The American Journal of Cardiovascular Pathology, 1(1), 3-14.
6. Friedrich, M. G., Sechtem, U., Schulz-Menger, J., Holmvang, G., Alakija, P., Cooper, L. T., ... &Mahrholdt, H. (2009). Cardiovascular magnetic resonance in myocarditis: a JACC White Paper. Journal of the American College of Cardiology, 53(17), 1475-1487.
7. Larsson, C. A., Ghassem-Zadeh, S. A., &DeMaria, A. N. (2003). Hemodynamically significant interventricular septal defect due to acute myocarditis. Journal of the American Society of Echocardiography, 16(10), 1086-1089.
8. Barbetseas, J., Papalois, A., Korovesis, S., &Stefanadis, C. (2005). Left ventricular outflow tract obstruction due to an acquired interventricular septal defect in a patient with myocarditis: a case report. European Journal of Echocardiography, 6(1), 74-77.
9. Mirza, K. Z., Chu, L. F., Rorick, N., Okunrintemi, V., Figueredo, V. M., & Konecny, T. (2018). Septal rupture complicating acute myocarditis: a rare and life-threatening disorder. Journal of the American College of Cardiology, 71(11_Supplement), A2353.
10. Mahrholdt, H., Wagner, A., Deluigi, C. C., Kispert, E., Hager, S., Meinhardt, G., ... &Sechtem, U. (2006). Presentation, patterns of myocardial damage, and clinical course of viral myocarditis. Circulation, 114(15), 1581-1590.
11. Assomull, R. G., Lyne, J. C., Keenan, N., Gulati, A., Bunce, N. H., Davies, S. W., ... & Pennell, D. J. (2007). The role of cardiovascular magnetic resonance in patients presenting

with chest pain, raised troponin, and unobstructed coronary arteries. EuropeanHeart Journal, 28(10), 1242-1249.
12. Kociol, R. D., Cooper, L. T., Fang, J. C., Moslehi, J. J., Pang, P. S., Sabe, M. A., ... &Dries, D. L. (2017). Recognition and initial management of fulminant myocarditis: a scientific statement from the American Heart Association. Circulation, 136(16), e133-e154.
13. Luetkens, J. A., Faron, A., Isaak, A., Dabir, D., Kuetting, D. L. R., Feisst, A., ... & Maintz, D. (2018). Comparison of original and 2018 Lake Louise criteria for diagnosis of acute myocarditis: results of a validation cohort. Radiology, 288(2), 426-432.
14. Schmitt-Grohe S, Selton-Suty C, Sevestre-Pietri M, et al. Features and outcomes of 899 patients with drug-induced eosinophilic myocarditis registered in the prospective multicenter DRUG-REACT-MI Registry. Eur J Heart Fail. 2013;15(6):703-710.
15. Batra AS, Lewis AB. Acute myocarditis. Current Opinion in Pediatrics. 2001 Jun 1;13(3):234-9.
16. Sotiris S. IsolatedForm of LeftVentricular Non-compaction Cardiomyopathy (LVNC) as a Rare Cause of Heart Failure. InCurrent Perspectives on Cardiomyopathies 2018 Sep 26. IntechOpen.