



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

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Study

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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.

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Keywords: Myocarditis; interventricular communication; heart failure; diagnosis; management; outcome.

ABREVIATIONS

MD : Doctor of Medicine (Title for medical doctors)
ECG : Electrocardiography
BNP : Brain Natriuretic Peptide
TTE : Transthoracic Echocardiography
TEE : Transesophageal Echocardiography
IVC : Interventricular Communication
MRI : Magnetic Resonance Imaging
ICU : Intensive Care Unit
IVIG : Intravenous Immunoglobulin
ECG : Electrocardiogram
EF : Ejection Fraction

1. INTRODUCTION

Acute myocarditis is inflammation of the myocardium. It is typically seen in young patients but can occur at any age. It most commonly results from a viral illness but can also be due to non-infectious etiologies. Given its variable clinical presentation, the diagnosis is frequently missed, making it difficult to quantify the true incidence and prevalence of the disease. Acute myocarditis constitutes most cases of myocarditis (65%) and is mainly caused by a viral illness [1]. It may less commonly be caused by non-infectious etiologies. There can either be a focal or diffuse involvement of the myocardium [2]. Consequently, its clinical manifestations vary widely, encompassing a broad spectrum of symptoms ranging from mild flu-like complaints to acute heart failure, arrhythmias, and, in rare cases, sudden cardiac death [3,4].

2. 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 bibasal bilateral 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.

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 severely reduced ejection fraction (EF) of 20% and a small left-to-right shunt consistent with an interventricular communication. The filling pressure was also high.

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.

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.

3. 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. Repeat transthoracic echocardiography 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.

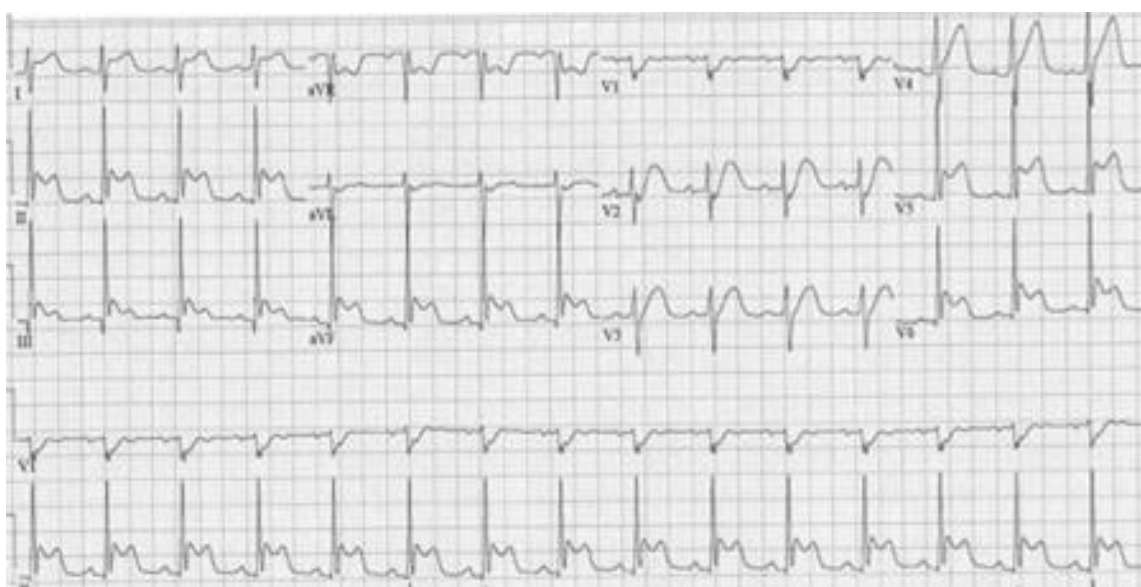


Fig. 1. patient ECG showing sinus tachycardia with diffuse ST-segment elevations

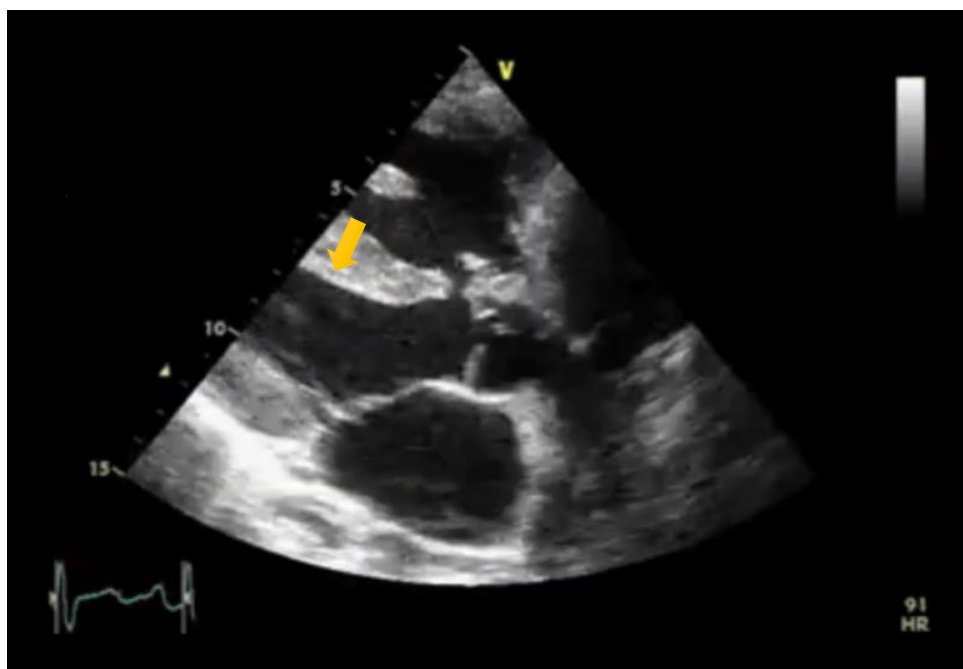


Fig. 2. TTE of the patient showing a small interventricular communication

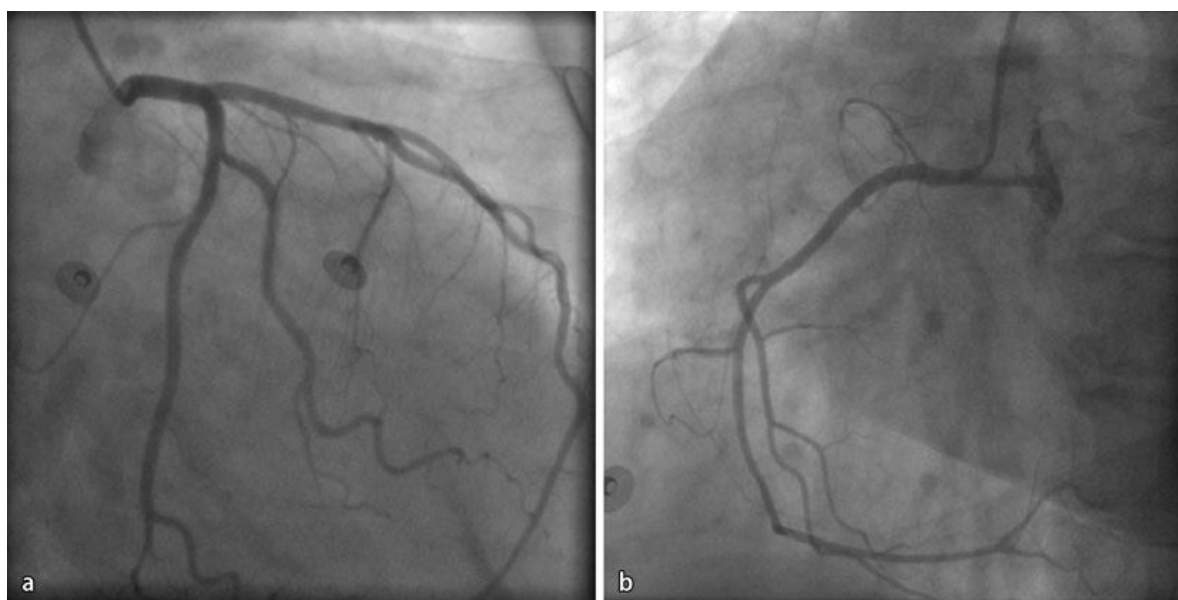


Fig. 3. Coronary angiography of the patient is normal

4. 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 [3]. While interventricular communication (IVC) is an exceedingly rare complication of myocarditis, its occurrence

underscores the importance of early diagnosis and comprehensive management strategies [4].

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 [5]. Elevated cardiac biomarkers, such as troponin I and BNP, served as initial indicators of myocardial injury and heart failure [6]. These findings are consistent with prior reports of myocarditis-associated heart failure [7].

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 [8]. 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 [9,10]. The presence of this direct communication between the left and right ventricles contributes to the unique clinical presentation of acute heart failure [11].

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 [12]. MRI also aids in differentiating myocarditis from other causes of cardiomyopathy, such as ischemic heart disease [13].

Treatment in this case involved a multidisciplinary approach. The patient received intravenous diuretics and inotropes to manage acute heart failure symptoms [14]. 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 [15].

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 [16].

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.

5. FUTURE PERSPECTIVES ON MANAGEMENT

The management of myocarditis has evolved considerably in recent years, driven by advancements in our understanding of the disease and improved diagnostic capabilities. Future management strategies are likely to be influenced by several key factors:

- 1. Personalized Medicine:** As our understanding of the diverse etiologies and pathophysiological mechanisms underlying myocarditis expands, there is a growing emphasis on personalized medicine. Tailoring treatment strategies to the specific cause of myocarditis (e.g., viral, autoimmune, toxic) may lead to more effective and targeted interventions [3].
- 2. Immunomodulatory Therapies:** Immunomodulatory therapies, including immunosuppressive agents and targeted biologics, are being explored as potential treatments for myocarditis, particularly in cases with a prominent autoimmune component [4]. The development of novel immunotherapies may revolutionize the management of inflammatory cardiac diseases.
- 3. Risk Stratification:** Identifying individuals at higher risk of adverse outcomes is crucial for optimizing management. Future research may yield better risk stratification tools, enabling healthcare providers to determine which patients require more aggressive treatment or closer monitoring.
- 4. Advancements in Imaging:** Continuous advancements in cardiac imaging, particularly cardiac MRI and molecular imaging, will likely play a pivotal role in the early diagnosis, risk assessment, and monitoring of myocarditis. These technologies are expected to become increasingly accessible and provide more detailed insights into myocardial inflammation and damage [5].

5. Patient Education and Awareness:

Increasing patient and healthcare provider awareness about myocarditis, its potential complications, and the importance of timely intervention will be essential for improved outcomes. Enhanced education efforts may lead to earlier diagnosis and treatment.

6. 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.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

CONSENT

As per international standard or university standard, patient(s) written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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