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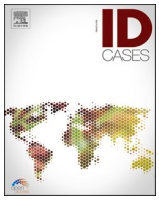

Case report

# A fatal case of fulminant myocarditis after influenza infection with a rapidly progressive course: A case report

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ABSTRACT

Myocarditis is an inflammation of the heart muscle. The most common cause of myocarditis is viral infections. clinical presentation of acute myocarditis is highly variable and varies from asymptomatic to fulminant heart failure or sudden death. Fulminant myocarditis is a severe form of myocarditis characterized by heart failure, arrhythmia, cardiogenic shock, and sudden cardiac arrest. Early diagnosis and proper treatment are essential for improved survival. We present a case of a 34-year-old woman who presented with viral symptoms for two days and then died suddenly.

## Introduction

Influenza has been associated with myocarditis but is a rare condition. The prevalence of fulminant myocarditis (FM) due to seasonal influenza has been established between 1% and 11% and that caused by H1N1 is estimated at 13% of these cases [1]. Although myocarditis is rare, it is a potentially fatal complication of influenza. FM accounts for approximately 10 % of all myocarditis cases, which rapidly deteriorates into heart failure, malignant arrhythmia, and cardiogenic shock within several days [2]. FM patients show higher rates of cardiac death [3].

## Case report

A 34-year-old woman with no significant past medical history presented to the emergency department with a three-day history of flu-like symptoms: general fatigue, fever, generalized myalgia, and worsening dyspnea. She was not previously vaccinated for influenza viruses and she was not receiving treatment. She had no family history of cardiovascular disease, no prior medical history, and no prior history of COVID-19 infection. At admission, her body temperature was 35.9 °C, respiratory rate 28/min, pulse rate 120 beats/min, and blood pressure 70/50 mmHg. Pulse oximetry showed an oxygen saturation of 92 %. A physical examination revealed respiratory distress, and peripheral skin mottling. The heart sounds were normal and the cardiac rhythm was regular. A chest radiograph obtained in an emergency room showed mild cardiac shadow enlargement. Laboratory findings included 26,000 leukocytes/$mm^3$ (84.5 % neutrophils), elevated highly sensitive troponin I level(1563), erythrocyte sedimentation rate (ESR) was 85, and elevated creatinine (1.6 mg/dl), with no other abnormalities. The 12-lead electrocardiogram (ECG) revealed sinus tachycardia, subtle ST-segment elevation in all leads except AVR, and V1 as well as ST-segment depression in the V1, and AVR leads (Fig. 1). Transthoracic echocardiography (TTE) showed severe biventricular systolic dysfunction with an LV ejection fraction (EF) of 20 % and mild pericardial effusion. A nasopharyngeal swab with real-time reverse transcriptase–polymerase chain reaction was positive for Influenza type A. We considered the patient to have fulminant myocarditis resulting in cardiogenic shock and admitted her to the intensive care unit. Treatment with dobutamine and noradrenaline was initiated. Intravenous immunoglobulin and corticosteroid pulse therapy with Methylprednisolone was started at 1000 mg stat. The patient's clinical condition worsened significantly after 1 h and had a decrease in ejection fraction from 20 % to 15 %; after this time. So intra-aortic balloon pump (IABP) insertion was done. Due to unresponsive, she was candid for Extracorporeal membrane oxygenation (ECMO) but sudden cardiac arrest occurred. Advanced life support was immediately started but was ineffective and the patient died. An autopsy was performed and the histopathology study showed acute myocarditis (Fig. 2).

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## Discussion

Viral infections are the most common cause of acute myocarditis [4], but they can also be caused by bacteria, parasites, drugs, and autoimmune diseases. It is known as acute myocarditis when it has less than a month of evolution [5]. Clinical presentations may vary from asymptomatic to fulminant myocarditis resulting in cardiogenic shock and death [6]. Influenza viruses are a major cause of morbidity and mortality worldwide. myocardial involvement as a result of influenza infection is a rare complication. The actual incidence of influenza myocarditis in the general population is unknown. Both type A and B can cause myocarditis although type B influenza is infrequent. Fulminant myocarditis is an aggressive form of acute myocarditis characterized by global ventricular dysfunction, generally with less than 3 days of evolution, with symptoms of heart failure, and hemodynamic compromise, with requirements for vasopressors or mechanical support. Myocarditis affects all age groups and both sexes. It is not clear why some people develop myocarditis and others do not after being infected by the virus. Similarly, it is unknown why some people with myocarditis are asymptomatic, and others develop fulminant heart failure. Some factors explaining this wide range include both host- and virus-specific factors. Influenza virus can cause cardiac complications through direct myocardial involvement as myocarditis. Most of the current investigations showed that the damage to the heart is produced by an immune response and not by direct damage to the cardiac cells [5]. FM leads to overactivation of the immune response and cytokine storm and is associated with immune dysfunction. So, immunomodulatory therapies are effective [7]. Endomyocardial biopsy is the diagnostic gold standard. Cardiac magnetic resonance imaging (MRI) is another useful diagnostic modality for myocarditis, especially in uncomplicated patients. The patient did not undergo endomyocardial biopsy, or MRI due to hemodynamic instability. The diagnosis of fulminant myocarditis in our patient was made according to a history of flu-like symptoms, abnormal ECG, low EF, elevated troponin, and changes in hemodynamics within a few hours. Most cases of viral infection causing myocarditis are seen in the young adult population, while our patient was 34 years old. Differential diagnoses include acute coronary syndrome coronary, vasospasm, ischemic cardiomyopathy, and pericarditis. There is no consensus on the best treatment. New treatment regimen, 'life support-based comprehensive treatment regimen' was introduced. This treatment includes aggressive medical therapy with glucocorticoid, immunoglobulin, and mechanical life-support including of IABP and ECMO [8]. With this regimen,the mortality rate was reduced from more than 50 % to less than 5 % [9].

Initiation of immunosuppression (e.g. steroid boluses) before PCR results may be crucial [10], which was also injected in our patient. Temporary mechanical circulatory support (MCS) as a bridge-to-recovery or bridge-to-transplantation is a reasonable consideration for fulminant myocarditis, but the type of temporary MCS and

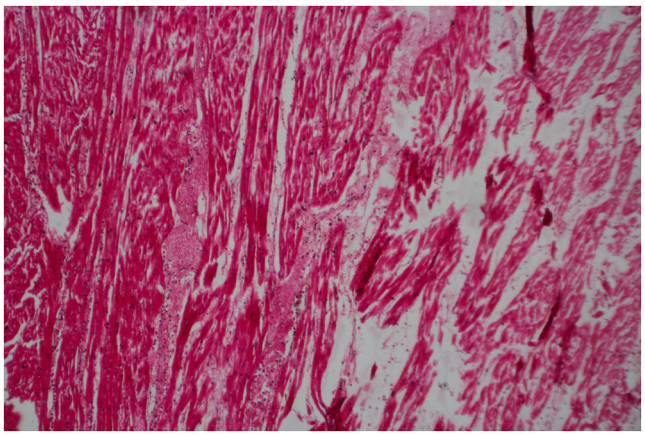

**Fig. 2.** Histopathologic examination of the autopsy specimen revealed marked and diffused infiltration of lymphocytes (thick arrow) within the myocardium.

the best timing of implantation are still a matter of debate. ECMO is the most useful way to provide full hemodynamic support, and early implementation of ECMO may be associated with better outcomes [11]. The patient in this case reported candid for the use of extracorporeal hemodynamic support, but she developed cardiac arrest. In the absence of rapid clinical improvement, candidacy for a heart transplant should be considered early [12]. Prognosis of the Myocarditis is challenging due to its multiple etiologies, variable presentations, and lack of documented treatment protocols. In adult patients, FM has a mortality rate of more than 50 % [13]. The mortality rate in patients with fulminant myocarditis who failed to respond to initial medical treatment is high. Our patient's condition did not improve despite the administration of intravenous fluid, inotrope, and IABP, and she died after four hours.

## Conclusion

This case study aimed to identify rare viral myocarditis as an influenza infection complication. The patient experienced cardiogenic shock resulting in her death 4 h after admission. This case study highlights a rare complication after influenza that needs high attention. Because of the wide spectrum of clinical presentations, clinicians need to consider myocarditis in the differential diagnosis of many cardiac syndromes. We recommend physician awareness of myocarditis after influenza infection for earlier diagnosis and treatment of this potentially fatal complication.

## CRediT authorship contribution statement

**Behnam Shakerian:** Conceptualization, Data curation, Investigation, Writing – original draft, Writing – review & editing. **Mohammad Hossein Mandegar:** Validation, Visualization.

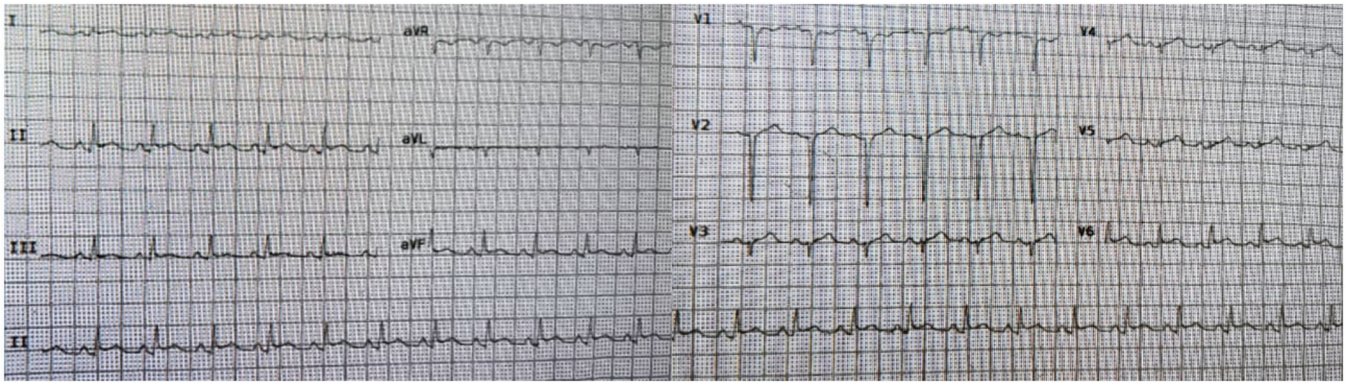


**Fig. 1.** Electrocardiography showed ST-segment elevation in all leads except AVR, and V1.

## Ethical approval

This submission has met ethics committee approval.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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## Author contributions

BS and MHM conceived and designed the study, and collected patient data. BS and MHM analyzed and interpreted data. BS wrote the initial and final drafts of the article. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Acknowledgement

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