ESC HEART FAILURE
*ESC Heart Failure* (2022)
Published online in Wiley Online Library (wileyonlinelibrary.com) **DOI:** 10.1002/ehf2.14229

CASE REPORT

# Clinically suspected lethal viral myocarditis combined with encephalitis: a COVID-19 vaccine complication

Junhui Chen[1,2], Ting Wu[3], Chunlei Zhang[1], Ye Zhang[4], Zhuanghua Liu[1] and Yuhai Wang[1]*

[1]*Department of Neurosurgery, 904th Hospital of Joint Logistic Support Force of PLA, Wuxi Clinical College of Anhui Medical University, No. 101 Xingyuan North Road, Liangxi District, Wuxi, 214044, Jiangsu Province, China;* [2]*Department of Human Anatomy and Neurobiology, School of Basic Medical Science, Central South University, Changsha, Hunan Province, China;* [3]*Department of Emergency, 904th Hospital of Joint Logistic Support Force of PLA, Wuxi Clinical College of Anhui Medical University, Wuxi, Jiangsu Province, China; and* [4]*Department of Cardiology, 904th Hospital of Joint Logistic Support Force of PLA, Wuxi Clinical College of Anhui Medical University, Wuxi, China*

## Abstract

This case study aimed to identify rare viral myocarditis combined with encephalitis as a COVID-19 vaccine complication. A 59-year-old male patient with a 2 day history of headache and rapidly progressive cognitive decline, who had received the third dose of COVID-19 vaccine 12 days before, was admitted to our hospital. The patient had no underlying systemic conditions, no prior medical history, and no prior history of COVID-19 infection. The patient was diagnosed with viral myocarditis and encephalitis by two neurologists and two cardiologists after laboratory examination, head computed tomography, and magnetic resonance imaging evaluation. The patient experienced cardiogenic shock and developed severe arrhythmia, resulting in his death 10 h after admission. Clinically suspected lethal viral myocarditis combined with encephalitis in the patient could be related to COVID-19 vaccination. Adverse effects of the Chinese COVID-19 vaccine, especially serious complications, have been uncommon. This case study highlights a rare complication after COVID-19 vaccination that needs high attention.

**Keywords** Case report; COVID-19 vaccine; Viral myocarditis; Encephalitis

*Received: 20 August 2022; Revised: 24 October 2022; Accepted: 28 October 2022*
**Correspondence to: Yuhai Wang, Department of Neurosurgery, 904th Hospital of Joint Logistic Support Force of PLA, Wuxi Clinical College of Anhui Medical University, No. 101 Xingyuan North Road, Liangxi District, Wuxi 214044, Jiangsu Province, China. Email: wangyuhai1516@163.com*
*Junhui Chen, Ting Wu, and Chunlei Zhang contributed equally.*

## Introduction

The global COVID-19 pandemic caused by the novel coronavirus SARS-CoV-2 has led to worldwide changes in public health measures, resulting in severe global mortality.[1] Approximately 647 100 individuals have been affected and 15 182 patients have died of COVID-19 in China, until 30 April 2022. The SARS-CoV-2 vaccine has proved to be an effective protective strategy to achieve sufficient herd immunity against SARS-CoV-2 infection and ultimately control the COVID-19 pandemic. More than 3.3 billion doses of the SARS-CoV-2 vaccine have been administered until 11 April 2022 in China, and almost 1.2 billion Chinese individuals have received the SARS-CoV-2 vaccine.

However, adverse effects have been reported worldwide post vaccination for COVID-19. Increasing studies are reporting complications associated with COVID-19 vaccines, particularly cardiovascular and cerebrovascular complications, including stroke, myocarditis, pericarditis, and viral inflammation.[2–4] Myocarditis has been reported to be a relatively rare complication after SARS-CoV-2 vaccine administration.[5,6] Similarly, the incidence of viral encephalitis after SARS-CoV-2 vaccination is extremely rare with only a few relevant clinical reports.[7] To our knowledge, to date, there have been no reports of lethal viral myocarditis combined with encephalitis following administration of any type of COVID-19 vaccine.

Herein, we report a case of a 59-year-old man presenting with rapidly progressive cognitive decline, deterioration of cardiac function, hyponatraemia, and suspected lethal viral myocarditis and encephalitis, occurring shortly after the third dose of COVID-19 vaccine.

## Case report

We report a case of a 59-year-old male patient with no underlying systemic conditions, no prior medical history, and

no prior history of COVID-19 infection, who received his third dose of COVID-19 vaccine (adenovirus vector, CanSino Biologics Inc) 12 days before being referred to us (*Figure 1*). The patient was transferred to the emergency department (Wuxi Taihu Hospital) from a local hospital, presenting a 2 day history of headache and rapidly progressive cognitive decline. The medical history was as follows: One day following COVID-19 vaccination, the patient had a low-grade fever and cough as lighter symptoms and did not undergo any drug treatment. For the next 7 days, the patient continued to do heavy work at the construction site and had no symptoms. On the ninth day after COVID-19 vaccination, the patient had a cough, nausea, and vomiting. The patient then self-administered himself with omeprazole suspecting gastropathy and continued to do heavy work at the construction site. On the night of the 11th day after COVID-19 vaccination, his family noticed that he was in a coma and had weakness in his right arm and leg. When presented to the local hospital, his body temperature was 39.2°C, and the score on the Glasgow Coma Scale (GCS) was 9 (scores range from 3 to 15, with lower numbers indicating greater coma severity). Head computed tomography (CT) showed a suspicious high-density shadow in the left parietal lobe brain sulcus, without infarction (*Figure 2A*). Then, head magnetic resonance imaging (MRI) performed before and after the administration of intravenous contrast material confirmed the presence of multiple infarct lesions, a diffuse high signal in the T2-weighted image (*Figure 2B,C*) and T2-weighted fluid-attenuated inversion recovery image (*Figure 2F,G*), and a low signal in the T1-weighted image (*Figure 2D,E*). Magnetic resonance angiography (MRA) and magnetic resonance venography (MRV) showed no occlusive thrombus in the intracranial large vessels and normal intracranial veins (*Figure 2H,I*). The patient received supportive therapies and symptomatic treatment. However, as the cognitive function continued to decline and the patient exhibited unstable vital signs, he was transferred to the emergency room of our hospital.

The emergency room physical examination revealed a GCS score of 6, whereas the score on the National Institutes of Health Stroke Scale (NIHSS) was 24 (scores range from 0 to 42, with higher numbers indicating greater stroke severity). Furthermore, the patient exhibited nuchal rigidity, positive Kremer's sign, a body temperature of 39.5°C, and diffuse macules on the back (*Figure S1*). The electrocardiograph (ECG) revealed ST- and T-wave changes, nodal tachycardia, and high voltage in the left ventricle (*Figure S2*). Chest CT showed bilateral pulmonary inflammatory changes, with high inflammation in the right lung, and an increase in the heart shadow (*Figure S3*). Laboratory examination results were as follows: Three throat swabs were negative for SARS-CoV-2 on real-time reverse-transcription polymerase chain reaction (RT-PCR) assays. Level of N-terminal pro-brain natriuretic peptide (NT-proBNP) was $>$35 000 pg/mL (reference range, 0 to 300), serum procalcitonin was 59.62 ng/mL (reference range, $<$0.5), cardiac troponin I was more than 26 ng/mL (reference range, 0 to 0.04), and myoglobin was 1694 ng/mL (reference range, 0 to 106). Diagnostic lumbar puncture and cerebrospinal fluid (CSF) analysis showed that white blood cell (WBC) count was $750*10^6$/L (reference range, 0 to 8), red blood cell (RBC) count was $7000*10^6$/L, CSF transparency was turbid (*Figure S4*), CSF culture was negative, and CSF glucose was normal. Moreover, protein levels were slightly high compared with those in the healthy individuals CSF, with 61.28 mg/L IgM (reference range, 0 to 1.3), 122 mg/L IgG (reference range, 0 to 34), and 30.7 mg/L IgA (reference range, 0 to 5); other antibodies tested were negative.

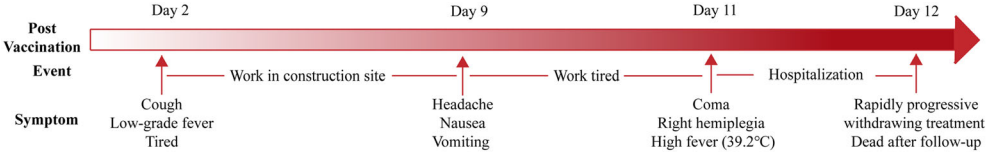
Based on the above findings, the patient was diagnosed with viral myocarditis and encephalitis by two neurologists and two cardiologists. The patient received guideline-directed medical therapy with methylprednisolone for heart failure. He further received antiviral, inotropic support, and life support therapies. However, the patient experienced cardiogenic shock and developed severe arrhythmia, resulting in his death 10 h after admission.

Family members of the patient did not provide consent to perform autopsy as a traditional Chinese concept. The diagnosis cannot be definitive as no viral genome testing, histological assay, or virus isolation and culture were performed. The diagnosis was thus just clinically suspected as lethal viral myocarditis combined with encephalitis related to COVID-19 vaccination; no additional causes of the condition were identified for this case.

## Discussion

To date, the adverse effects of the Chinese COVID-19 vaccine, especially serious complications, have been uncommon. Al-

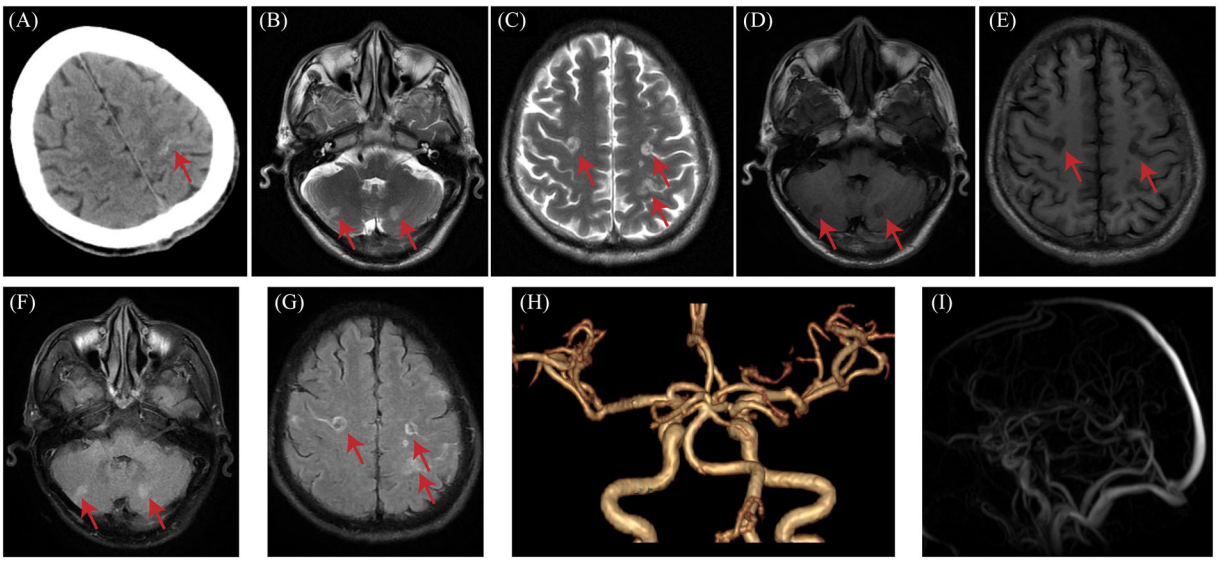
**Figure 1** Timeline of clinical course, event, and symptoms.





DOI: 10.1002/ehf2.14229

**Figure 2** Computed tomography (CT) and magnetic resonance imaging (MRI) scan of the head. An axial CT image (Panel A) shows a suspicious high-density shadow in the left parietal lobe brain sulcus (red arrow). An axial MRI T2-weighted image (Panels B and C) shows multiple and diffuse high signals in the cerebellum and parietal lobe (red arrow). An axial MRI T1-weighted image (Panels D and E) shows multiple and diffuse low signals in the cerebellum and parietal lobe. An axial MRI fluid-attenuated inversion recovery sequence (Panels F and G) shows multiple and diffuse high signals in the cerebellum and parietal lobe. Magnetic resonance angiography (Panel H) indicates absence of large intracranial vessel occlusion. Magnetic resonance venography (Panel I) shows a normal intracranial venous system.




though rare, such complications require high attention after COVID-19 vaccine. Firstly, all individuals receiving the vaccine need to be carefully assessed for age, underlying diseases, and physical fitness to understand the potential risks of vaccination. The community vaccination centre found that vaccination response was more common and relatively severe in individuals administered the CanSino Biologics adenovirus vector COVID-19 vaccine than in those administered other COVID-19 vaccines, after follow-up. Hence, elderly people with poor physical conditions or underlying medical conditions should avoid receiving the CanSino Biologics adenovirus vector COVID-19 vaccine as much as possible. Secondly, the importance of the Chinese COVID-19 vaccine adverse events reporting system needs to be emphasized. Attention should be paid to follow-up and management after vaccination, especially for those who develop symptoms after vaccination. Standardization of follow-up management and vaccine adverse events reporting system is vital as early recognition, diagnosis, and treatment are necessary to achieve a favourable prognosis. Thirdly, it is necessary to strengthen training and learning related to vaccine adverse events and formulate management guidelines for these adverse events in all Chinese hospitals.

Recently (since April 2022), the number of SARS-CoV-2-infected cases in China (main in Shanghai) showed a sharp increase. However, the outbreak was quickly blocked owing to the implementation of China's zero-COVID policy. Hence, Mainland China should continue maintaining a zero-COVID policy even if it presents many challenges.[8] Additionally, lethal vaccine adverse events including viral myocarditis and encephalitis, even though extremely rare, should not be allowed to become a negative factor that prevents vaccination. Moreover, universal vaccination should now be focused upon as the most important strategy to reduce community spread.

## Acknowledgements

We thank Bullet Edits Limited for linguistic editing and proofreading of the manuscript.

## Conflict of interest

The authors declare that they have no conflict of interest.

## Funding

This work was supported by the Jiangsu Provincial Natural Science Foundation (Grant No. BK20201140) and Top Talent Support Program for young and middle-aged people of Wuxi Health Committee (HB2020119).

## Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Figure S1.** Physical examination image shows diffuse macules on the patient's back.

**Figure S2.** ECG findings.
Panel A shows the ECG images captured at the local hospital. Panel B shows the ECG images captured at our hospital (5 h after the first ECG).

**Figure S3.** Chest CT findings.

**Figure S4.** The appearance and transparency of cerebrospinal fluid after lumbar puncture.

## References


1. Yasin A, Aydin S, Sümbül B, Koral L, Şimşek M, Geredeli Ç, Öztürk A, Perkin P, Demirtaş D, Erdemoglu E, Hacıbekiroglu İ, Çakır E, Tanrıkulu E, Çoban E, Ozcelik M, Çelik S, Teker F, Aksoy A, Fırat ST, Tekin Ö, Kalkan Z, Türken O, Oven BB, Dane F, Bilici A, Isıkdogan A, Seker M, Türk HM, Gümüş M. Efficacy and safety profile of COVID-19 vaccine in cancer patients: a prospective, multicenter cohort study. *Future Oncol*. 2022; **18**: 1235–1244.
2. De Michele M, Kahan J, Berto I, Schiavo OG, Iacobucci M, Toni D, Merkler AE. Cerebrovascular complications of COVID-19 and COVID-19 vaccination. *Circ Res*. 2022; **130**: 1187–1203.
3. Block JP, Boehmer TK, Forrest CB, Carton TW, Lee GM, Ajani UA, Christakis DA, Cowell LG, Draper C, Ghildayal N, Harris AM, Kappelman MD, Ko JY, Mayer KH, Nagavedu K, Oster ME, Paranjape A, Puro J, Ritchey MD, Shay DK, Thacker D, Gundlapalli AV. Cardiac complications after SARS-CoV-2 infection and mRNA COVID-19 vaccination—PCORnet, United States, January 2021–January 2022. *MMWR Morb Mortal Wkly Rep*. 2022; **71**: 517–523.
4. Oxley TJ, Mocco J, Majidi S, Kellner CP, Shoirah H, Singh IP, de Leacy RA, Shigematsu T, Ladner TR, Yaeger KA, Skliut M, Weinberger J, Dangayach NS, Bederson JB, Tuhrim S, Fifi JT. Large-vessel stroke as a presenting feature of Covid-19 in the young. *N Engl J Med*. 2020; **382**: e60.
5. Rosner CM, Genovese L, Tehrani BN, Atkins M, Bakhshi H, Chaudhri S, Damluji AA, de Lemos JA, Desai SS, Emaminia A, Flanagan MC, Khera A, Maghsoudi A, Mekonnen G, Muthukumar A, Saeed IM, Sherwood MW, Sinha SS, O'Connor CM, deFilippi CR. Myocarditis temporally associated with COVID-19 vaccination. *Circulation*. 2021; **144**: 502–505.
6. Karlstad Ø, Hovi P, Husby A, Härkänen T, Selmer RM, Pihlström N, Hansen JV, Nohynek H, Gunnes N, Sundström A, Wohlfahrt J, Nieminen TA, Grünewald M, Gulseth HL, Hviid A, Ljung R. SARS-CoV-2 vaccination and myocarditis in a Nordic cohort study of 23 million residents. *JAMA Cardiol*. 2022; **7**: 600–612.
7. Moslemi M, Ardalan M, Haramshahi M, Mirzaei H, Sani SK, Dastgir R, Dastgir N. Herpes simplex encephalitis following ChAdOx1 nCoV-19 vaccination: a case report and review of the literature. *BMC Infect Dis*. 2022; **22**: 217.
8. Chen JM, Chen YQ. China can prepare to end its zero-COVID policy. *Nat Med*. 2022; **28**: 1104–1105.