EXPERT OPINION

Adverse Reactions and Therapeutic Approaches in the Treatment of COVID-19-Induced Viral Myocarditis

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ABSTRACT

In recent years, an increasing number of sudden deaths among middle-aged and young adults in sub-health conditions caused by COVID-19-related myocarditis have underscored the virus's potential threat to this population. At present, there is no specific treatment for viral myocarditis, and commonly used antiviral drugs often cause adverse reactions. This paper explores a novel therapeutic strategy for viral myocarditis by adopting the integrative approach of Chinese and Western medicine that has proven effective in cancer treatment. Mechanistically, this approach appears feasible. Continuous innovation in clinical medicine is essential to benefit patients.

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1. Introduction

A report published in The New England Journal of Medicine (2021) analyzed data from nearly one thousand U.S. hospitals and found that patients hospitalized with COVID-19 had a 16-fold higher incidence of myocarditis compared with non-COVID patients. The number of acute fulminant myocarditis cases triggered by SARS-CoV-2 infection has also risen accordingly.

COVID-19 patients and those with long COVID are at higher risk of developing viral myocarditis; however, there is currently no specific treatment available. It is therefore imperative to develop a safe and effective clinical protocol for managing viral myocarditis. Accomplishing this goal is a key mission for contemporary medical and pharmaceutical researchers.

2. Overview of Viral Myocarditis

Patients with COVID-19 or long COVID often exist in a state of immunosuppression commonly described as “sub-health,” which renders them more susceptible to viral infections that trigger myocardial injury and lead to myocarditis. Myocarditis is characterized by localized or diffuse inflammatory lesions of the myocardium.

In patients infected with SARS-CoV-2, serum levels of cardiac enzymes and troponins are often elevated; the greater the increase in biomarkers such as cardiac troponin I (cTnI) or troponin T (cTnT), the more severe the extent of myocardial damage (Gluckman et al., 2022).

Current studies have identified three main types of viral myocarditis associated with SARS-CoV-2 infection:

2.1 Myocarditis caused directly by SARS-CoV-2 infection;

2.2 Myocarditis associated with multisystem inflammatory syndrome induced by SARS-CoV-2;

2.3 Myocarditis related to mRNA-based COVID-19 vaccines (not discussed in this paper).

3. Etiology and Prognosis

3.1 Etiology:

According to the American College of Cardiology (ACC) Expert Consensus Decision Pathway on Cardiovascular Sequelae of COVID-19 in Adults, SARS-CoV-2 infection can cause various forms of myocardial injury, including myocarditis, type I and type II myocardial infarction, multisystem inflammatory syndrome (MIS), and Takotsubo (stress-induced) cardiomyopathy [2].

3.2 Prognosis:

In the early stage of COVID-19 infection, the virus activates a cascade of inflammatory cytokines that invade cardiomyocytes, leading to cell injury. The virus may also infect coronary endothelial cells, causing endothelial damage and thrombus formation, resulting in myocardial ischemia and further injury.

These pathological processes can cause acute heart failure, arrhythmias, and cardiogenic shock — characterized by sudden onset, rapid progression, and poor prognosis. Patients often experience a sudden decline in vital signs such as hypotension, altered consciousness, cardiac arrest, or sudden death, frequently accompanied by respiratory, hepatic, or renal failure (Huang C et al., 2020, Lala A et al., 2020, Wang et al., 2020).

4. Current Diagnostic Status

4.1 According to The New England Journal of Medicine, early identification of viral myocarditis in COVID-19 patients is difficult because of the absence of unified diagnostic

criteria. Biomarkers of myocardial injury may also reflect secondary rather than primary damage. Studies report that elevated serum myocardial enzyme levels can indicate cardiac involvement, and approximately 15 – 27.8 % of severe COVID-19 pneumonia cases show evidence of myocardial injury (Chimenti et al., 2022).

The difficulty of early diagnosis often leads to viral myocarditis being overlooked during recovery, increasing the risk of underestimating its long-term cardiovascular consequences.

4.2 Professor Chris Goodnow, Director of the Immunogenomics Laboratory at the Garvan Institute of Medical Research and the Cellular Genomics Future Institute at the University of New South Wales, contracted COVID-19 and later published Reflections of an Australian Immunologist: From Infection to Myocarditis (Goodnow, n.d.). He noted that despite full vaccination, infection with the Omicron variant still led to myocarditis and persistent cardiac discomfort after recovery. He warned: "COVID-19 is not a common cold; recovery does not mean one can let down their guard."

5. Common Symptoms of SARS-CoV-2-Induced Myocarditis

5.1 Early Clinical Manifestations:

Initial symptoms often resemble those of upper-respiratory-tract infection, including fever, fatigue, nasal congestion, runny nose, sore throat, cough, and diarrhea. About one week after infection, some patients develop shortness of breath, dyspnea, chest tightness, chest pain, palpitations, dizziness, loss of appetite, insomnia, severe fatigue, and multi-organ damage, progressing to hemodynamic instability (World Health Organization [WHO], 2021). Certain patients experience acute heart failure, pulmonary congestion, or cardiogenic shock, manifesting as cold clammy skin, pallor, cyanosis, mottling, and impaired consciousness. A small number may suffer syncope or sudden cardiac death — typical of fulminant myocarditis (Chinese Society of Cardiology & Working Group on Adult Fulminant Myocarditis, 2017).

6. Treatment of Viral Myocarditis

6.1Currently, there is no specific therapy for viral myocarditis. Clinical management focuses on symptomatic relief of viral infection and myocardial inflammation. Commonly used drugs include ribavirin tablets, acyclovir tablets, valacyclovir capsules, human interferon α-2b injection, and glucocorticoids ((Heart Failure Committee of the Chinese Medical Doctor Association, 2022)). Most patients achieve improvement after treatment, but some develop drug-related side effects or progress to dilated cardiomyopathy.

Long-term recovery depends on sustained comprehensive care, including a balanced diet, moderate exercise, and the use of safe, effective natural medicines to enhance endogenous immune function.

6.2 Although Western medicine can effectively control myocardial inflammation, antiviral drugs often produce adverse effects requiring additional interventions. For example, ribavirin is commonly used for viral myocarditis, bronchopneumonia, and herpesvirus infections but can cause headache, insomnia, loss of appetite, nausea, vomiting, diarrhea, and constipation, and reduce white cells, red cells, and hemoglobin. Symptoms such as nausea and anorexia impair spleen and stomach function, leading to malnutrition and bone-marrow suppression, thereby weakening immunity and reducing the body's ability to eliminate pathogens.

Hence, clinicians must recognize that viral myocarditis is not merely a localized cardiac disease but affects the entire system — as the medical aphorism says, "Do not see only the

trees and forget the forest."

7. Exploring the Integration of Chinese and Western Medicine in Treating Viral Myocarditis

7.1 In the treatment of SARS-CoV-2-induced myocarditis, antiviral agents such as ribavirin, valacyclovir, and interferon α-2b injections aim to rapidly suppress viral replication in the respiratory and cardiovascular systems. At the same time, the addition of clinically verified Chinese patent medicines — proven safe and effective through toxicological and pharmacological studies — may reduce myocardial cell injury caused by antiviral drugs, enhancing therapeutic efficacy and alleviating suffering. This approach is mechanistically analogous to the integrative treatment used in oncology.

7.2 Both viral myocarditis and cancer are systemic immune disorders. Ribavirin therapy may induce vomiting, diarrhea, and leukopenia (Ribavirin Tablets Drug Monograph, n.d.); chemotherapeutic agents such as anthracyclines, taxanes, and alkylating agents cause similar toxicities. These drugs suppress bone-marrow hematopoiesis and damage cardiomyocytes; anthracyclines (including doxorubicin and daunorubicin) can cause irreversible myocardial injury and cardiac remodeling. If untreated, such "drug-induced diseases" lead to heart failure or sudden death. Some cancer patients die not from the tumor itself but from chemoradiation-induced bone-marrow suppression and febrile neutropenia, which raise infection rates, mortality, and costs. Major institutions — the Cancer Hospital of the Chinese Academy of Medical Sciences, Beijing Cancer Hospital, Yunnan Cancer Hospital, and Egypt's National Cancer Institute — have shown that integrative Chinese-Western therapy using the herbal formula SYKT can significantly reduce radiochemotherapy toxicity and improve outcomes. The same principle may apply to viral myocarditis.

7.3 A doctoral project at Kunming Medical University created a mouse model of bone-marrow suppression and cardiotoxicity induced by doxorubicin and treated it with SYKT, a patented Chinese medicine known to stimulate hematopoiesis and enhance immunity. Results showed that SYKT significantly alleviated both bone-marrow suppression and cardiotoxicity without reducing anti-tumor efficacy. Mechanistically, SYKT acts by inhibiting cellular reactive oxygen species (ROS) generation and thereby reducing apoptosis in bone-marrow and cardiomyocytes (Chen et al., 2017).

8. Evidence-Based Validation of a Safe and Effective Therapy

8.1 Animal studies confirm that SYKT enhances bone-marrow hematopoiesis and protects cardiomyocytes, but clinical efficacy in humans requires verification through evidence-based research.

8.1.1 A multicenter, randomized, double-blind trial conducted by the Cancer Hospital of the Chinese Academy of Medical Sciences, Beijing Cancer Hospital, PLA 307 Hospital, Liaoning Cancer Hospital, and Yunnan Cancer Hospital evaluated radiotherapy combined with SYKT for locally advanced non-small-cell lung cancer (NSCLC). The objective response rate (ORR = CR + PR) was 77.42 % in the SYKT group versus 53.33 % in controls (P = 0.048). Quality of life and body weight improved more in the SYKT group, and SYKT did not increase radiotherapy-related adverse events (Lü et al., 2004).

8.1.2 A study of 289 patients at Yunnan Cancer Hospital found that radiotherapy plus SYKT prolonged median overall survival to 27.3 months versus 23.1 months with G-CSF (P = 0.01), and ORR was 74.81 % vs 56.96 % (P = 0.002). Bone-marrow toxicity was lower (P = 0.023) and immune function higher (P = 0.000)

in the SYKT group (Wang et al., 2018).
8.1.3 At the First Affiliated Hospital of Kunming Medical University, a trial on head-and-neck squamous cell carcinoma showed that adding SYKT to paclitaxel + cisplatin chemoradiotherapy (RT+TP) reduced the severity and duration of bone-marrow suppression, improved Karnofsky Performance Status (KPS), and maintained higher white-cell, neutrophil, and hemoglobin levels ($P < 0.01$) (Zhou et al., 2015).

9. Discussion

9.1 Both animal and clinical evidence indicate that the Chinese medicine SYKT is safe and effective for treating chemotherapy-induced leukopenia and thrombocytopenia, and for mitigating anthracycline-related cardiotoxicity. Therefore, combining antiviral agents with SYKT could potentially treat SARS-CoV-2-induced myocarditis while reducing adverse effects from antivirals.
Some long-COVID patients with chest tightness, palpitations, dizziness, or dyspnea experienced marked symptom relief after one to two months of SYKT therapy. Nonetheless, the efficacy of an "antiviral drug + SYKT" regimen must be confirmed through evidence-based clinical studies.
9.2 Throughout medical history, creative thinking grounded in logical reasoning has driven clinical progress. Can a new treatment for viral myocarditis be developed from the oncologic model of "radiotherapy + chemotherapy + SYKT"? This paper suggests a mechanistic correlation. Pharmaceutical researchers must uphold a spirit of exploration and innovation to serve patients worldwide and benefit people of all backgrounds.

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