Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letters to the Editor

Cardiac valves: Another "Disaster-hit area" of COVID-19 patients?

To the Editor,

Coronavirus disease 2019 (COVID-19), characterized by acute respiratory failure and multiple organs damages, has been becoming a pandemic disease around the world since December 2019. The pathogenthat induced COVID-19 is severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) .[1,2] According the data from the World Health Organization (WHO), by 27 April 2020, there have been 2883,603 confirmed cases of COVID-19 with 198,842 deaths.[3] Although respiratory failure is the main clinical character of COVID-19 patients, quite a few patients developed cardiovascular diseases, such as cardiac arrest, myocarditis and arrhythmia.[4] However, the effect of COVID-19 on cardiac valves, the hinge during the process of blood flow, has not been fully identified pathologically and functionally. Therefore, it is a significant question that whether the SARS-CoV-2 virus could attack the cardiac valves.

Angiotensin-converting enzyme 2 (ACE2) has been identified as the receptor for SARS-CoV-2, mediating its entry to host cells.[5] Except in the lung, ACE2 generally expresses in alimentary canal, kidney, testis and heart. With regards to the heart, expression of ACE2 in myocardium and associated myocardial pathology have been wildly reported.[4] Additionally, ACE2 was also detected in cardiac valves, specifically aortic valve in human, and associated with the process of aortic valve stenosis. Detected by immunostaining, ACE2 located at stromal fibroblasts, mainly in spongiosa layer. Stenotic valves showed decrescent extensiveness of ACE2 and abnormal expression of ACE2 in macrophages and myofibroblasts surrounding neovessels. Compared with normal valves, downregulated ACE2 in stenotic valves was determined by RT-PCR. Downregulation of ACE2/Angiotensin-(1−7)/Mas receptor axis may promote fibrosis, proliferation and inflammation in cardiac valves, causing valvular sclerosis and hemodynamic disorder finally.[6] Considering the complex and dynamic changes of SARS-CoV-2 in infected soma, the $ACE2^+$ cells in cardiac valves could be attacked by SARS-CoV-2 directly. Dysfunction of these cells could induce pathological procedure in cardiac valves and obstruct regular blood flow consequently.

Formation of hyaline thrombus in small vessels, degeneration and necrosis of parenchymal cells and other pathological changes of chronic diseases could be caused by cytokine storm.[4, 7] Cytokine storm, another lethal pathology in COVID-19 featured with IL6, IL10 and TNF-α, may play an important role in the regression and maintenance of valvular lesions.[8, 9]

Cardiac valves disease is usually slow-moving and often requires a long journey from the "ignition" of pathology to related clinical symptoms. As the direct attack mediated by $ACE2^+$ cells and indirect attack from cytokine storm, the damages in cardiac valves induced by SARS-CoV-2 could not be ignored. Thus, we emphatically advise that the survivors of COVID-19, especially those with acquired heart disease, should be examined for cardiac function periodically after recovery. The expression and biological function of ACE2 in cardiac valves should be identified further and cohort studies about cardiac valves targeting infected populations may provide guidance to public health policy.

Declarations

Ethical statement

The article doesn't contain the participation of any human being and animal.

Original publication

This work described has not been published previously and it is not under consideration for publication elsewhere.

Patient consent

Not applicable

Source of support

None

Author contributions

Xiaoyong Li: Writing-original draft, Sha Yu: Writing-review & editing, Sha Yu designed this project and Xiaoyong Li drafted this manuscript.

Declaration of Competing Interest

These authors declare no conflict of interest. All the authors have read and approved this manuscript.

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