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MMRI/AHA STUDY FINDS COVID LINK TO HEART DAMAGE

*SARS-CoV-2 Spike Protein Activated Natural Immune Response,
Damaged Heart Muscle Cells*

UTICA, NY — Heart damage is common among patients hospitalized with Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2, the virus which causes COVID-19), leading many to wonder how it is that the virus affects the heart.

Now, researchers show that the spike protein from SARS-CoV-2 can lead to heart muscle injury through a specific inflammatory process, leading to heart injury. Zhiqiang Lin Ph.D., Assistant Professor at the Masonic Medical Research Institute in Utica, New York, led the team which made the discovery. The American Heart Association announced the findings Monday, July 25, in Chicago at the AHA Basic Cardiovascular Sciences Meeting.

"It's known from the clinical side that COVID can induce heart injury; however, what we don't know is the mechanism for how this occurs. What we suspect is that the spike protein has a likely pathological role," said Dr. Lin. "Our data show for the first time that the spike protein from SARS-CoV-2 causes heart muscle damage. That's why it's important to get vaccinated, to prevent this devastating disease."

The spike protein is found on the surface of SARS-CoV-2, which latches on to a receptor known as angiotensin-converting enzyme 2 (ACE2) on target cells. In this manner, therefore, the spike protein can facilitate virus entry into healthy cells, which is the first step in infection. In addition to infecting the heart and lungs, the virus can also spread to other organs, leading to more damage to the body, severe infection, and, among some people, death.

"Host natural immunity is the first line of defense against pathogenic invasion, and heart muscle cells have their own natural immune machinery. Activation of the body's immune response is essential for fighting against virus infection. However, this may also impair heart muscle cell function and even lead to cell death when it is overstimulated," Lin said.

In this study, Lin and his research group found that the SARS-CoV-2 spike protein interacts with a unique inflammatory receptor called Toll-Like Receptor 4 (TLR4) to initiate a natural immune response in heart muscle cells. This is specific to COVID-19 infection, as a different spike protein from another coronavirus previously shown to cause flu symptoms but no heart injury did not mediate this response.

"The fact that the SARS-CoV-2 spike protein is uniquely activating the natural immune response may explain the high virulence levels when compared to other coronaviruses," Lin said. "TLR4 signaling is the major pathway that activates the body's natural immune response, and the SARS-CoV-2 spike protein activates TLR4, a response not seen from a regular flu viruses or other coronavirus spike proteins."



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Dr. Lin noted too, for those who might question the difference between the common flu and COVID, that there are in fact major differences in the viruses. His study is another proof point for this difference. "Regular flu rarely causes heart damage," Lin noted, "however, COVID-19 can especially impact the heart."

Co-authors are Caroline Sheldon, B.A.; Steven Negron, B.A.; Chase W. Kessinger, Ph.D.; Bing Xu, Ph.D.; William T. Pu, M.D.; and Chieh-Yu Lin, M.D., Ph.D.

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