# New imaging tool for diagnosing heart disease

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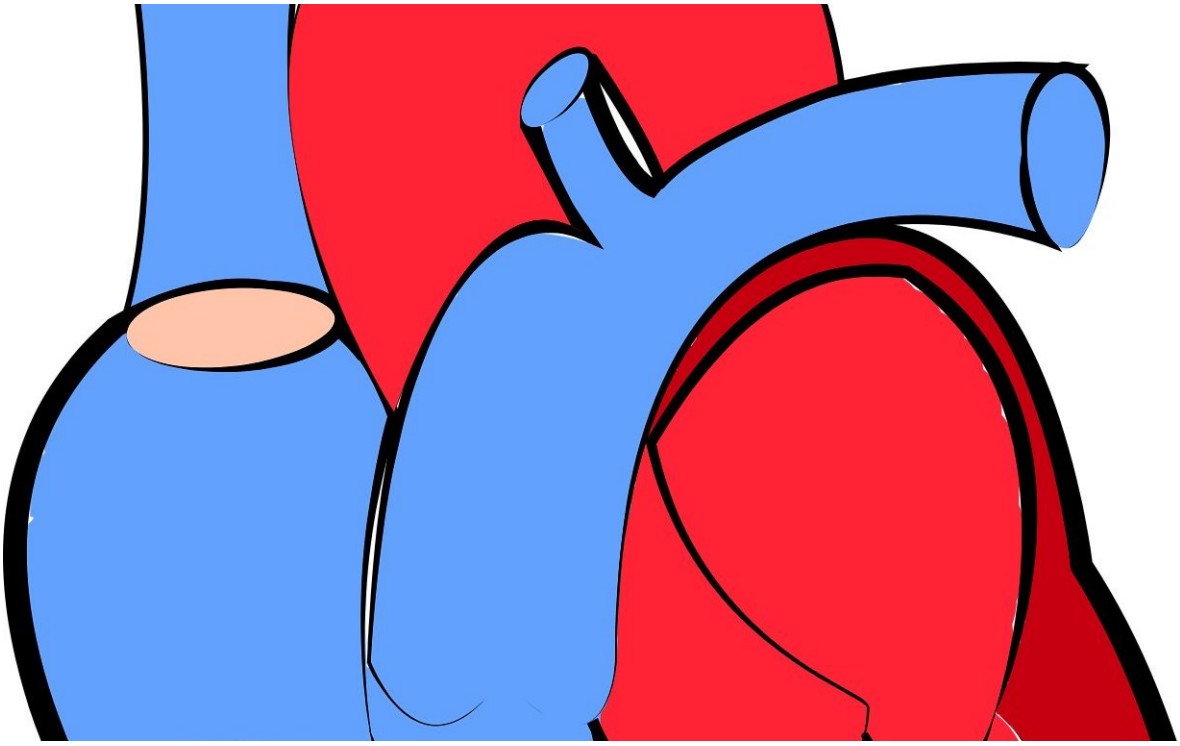

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An international team led by scientists from Lawson Health Research Institute and Cedars-Sinai Medical Center are the first to show that Magnetic Resonance Imaging (MRI) can be used to measure how the heart uses oxygen for both healthy patients and those with heart disease.

Reduced blood flow to the heart muscle is the leading cause of death in the Western world. Currently, the diagnostic tests available to measure blood flow to the heart require injection of radioactive chemicals or contrast agents that change the MRI signal and detect the presence of disease. There are small but finite associated risks and it is not recommended for a variety of patients including those with poor kidney function. More than 500,000 tests are performed each year in Canada.

"This new method, cardiac functional MRI (cfMRI), does not require needles or chemicals being injected into the body," says Dr. Frank Prato, Lawson Assistant Director for Imaging. "It eliminates the existing risks and can be used on all patients."

The team included researchers from Lawson; Cedars-Sinai Medical Center and University of California; King's College in the United Kingdom; University Health Network and the University of Toronto; Siemens Healthineers; and, University of Edinburgh in the United Kingdom.

"Our discovery shows that we can use MRI to study heart muscle activity," explains Dr. Prato. "We've been successful in using a pre-clinical model and now we are preparing to show this can be used to accurately detect heart disease in patients."

Repeat exposure to carbon dioxide is used to test how well the heart's blood vessels are working to deliver oxygen to the muscle. A breathing machine changes the concentration of carbon dioxide in the blood. This change should result in a change in blood flow to the heart, but does not happen when disease is present. The cfMRI method reliably detects whether these changes are present.

Other researchers have explored oxygenation-sensitive MRI but initial results contained a high level of 'noise' with blurry images. Project

leader and partner Dr. Rohan Dharmakumar, Associate Director of the Biomedical Imaging Research Institute at Cedars-Sinai Medical Center, believed that the noise was actually variation in the heart's processing of oxygen. He engineered a way to average this variation and through testing at Lawson the team discovered that the noise is actually a new way to study how the heart works.

"We've opened the door to a new era and totally novel way of doing cardiac stress testing to identify patients with ischemic heart disease" says Dr. Dharmakumar. "This approach overcomes the limitations of all the current diagnostics—there would no longer be a need for injections or physical stress testing like running on treadmills."

"Using MRI will not only be safer than present methods, but also provide more detailed information and much earlier on in the disease process," adds Dr. Prato. Following initial testing through clinical trials, he sees this being used with patients clinically within a few years.

In addition to studying coronary artery disease, the method could be used in other cases where heart blood flow is affected such as the effects of a heart attack or damages to the heart during cancer treatment. Due to its minimal risk, this new tool could be safely used with the same patient multiple times to better select the right treatment and find out early on if it is working. Dr. Prato notes that "with this new window into how the heart works, we have a lot to explore when it comes to the role of oxygen in health and disease."

The study "Accurate needle-free assessment of myocardial oxygenation for ischemic heart disease in canines using Magnetic Resonance Imaging" is being published in *Science Translational Medicine*.

**More information:** Hsin-Jung Yang et al, Accurate needle-free assessment of myocardial oxygenation for ischemic heart disease in

canines using magnetic resonance imaging, *Science Translational Medicine* (2019). DOI: 10.1126/scitranslmed.aat4407