Cardiac imaging breakthrough developed at the University of Western Ontario

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Cardiologists and surgeons may soon have a new tool to improve outcomes for patients requiring pacemakers, bypass surgery or angioplasties. Research led by Dr. James White and his colleagues at The University of Western Ontario has led to a new imaging technique, which provides a single, 3D high-resolution image of the heart revealing both its vasculature and the presence of scar tissue within the muscle. This novel imaging was performed using a 3-Tesla MRI at Western's Robarts Research Institute. The findings are published on-line in the *Journal of the American College of Cardiology: Cardiovascular Imaging*.

Injuries to the heart, including heart attacks or viral inflammation, commonly result in permanent damage or scarring of its muscle. "We've known for some time that myocardial (heart) scar tissue can be imaged using MRI, but what we've now been able to do is to take this imaging to another level," explains Dr. White. "This is the first time we have been able to visualize myocardial scar and the heart's blood vessels at the same time. We are able to construct a three dimensional model of a person's heart to immediately understand the relationship between the heart's blood vessels and related permanent injury. This will help direct surgeons and cardiologists to better target the blood vessels that lead to muscle capable of responding to their therapy, rather than to muscle that is irreversibly diseased."

The technique works by first acquiring a 3D coronary image using a continuous infusion of a contrast called gadolinium, which makes the blood-pool light up brightly. The 3-T MRI takes images as this contrast

is infused into the blood stream, providing a high resolution, 3-D image of the heart showing coronary blood vessels. Scar tissue is slow to give up this contrast agent and its signal is therefore retained despite a washing out of contrast from the blood stream and normal tissues. A repeat image, performed 20 minutes later, highlights the heart's scar, also in 3D. Because the two images are taken in the identical way using the exact same MRI pulse sequence, they're already perfectly suited to be fused to one another. The result is a fused, 3D model of the heart that shows both the heart's vessels and scar tissue.

The imaging technique was performed on 55 patients referred for either bypass surgery or a specialized pacemaker designed to improve heart function called Cardiac Resynchronization Therapy (CRT), demonstrating that the procedure was clinically feasible. The study was able to demonstrate that this novel imaging technique may be valuable in the planning of these vascular-based cardiac interventions. Dr White describes that in bypass or angioplasty procedures surgeons have to decide whether or not to open up blocked blood vessels, but if they can see there is scar in that region, no benefit will be expected. Similarly, CRT pacemaker leads delivered to regions of scarred heart muscle may prevent any benefit from this therapy.

Provided by University of Western Ontario