

More effective, non-invasive test uses artificial intelligence to detect blocked arteries

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As a patient with a family history of heart disease, Karen Moore has always been diligent about monitoring her heart health. When her

primary care doctor heard something unusual during a routine examination, she sent Moore to cardiologist Mark Rabbat, MD, associate professor of medicine and radiology and director of cardiac computed tomography (CT) at Loyola Medicine. Her initial tests, including electrocardiogram (ECG), echocardiograms and magnetic resonance images (MRI) did not detect any blockages. However, Moore's symptoms never went away. "The tests didn't show anything, but I still was short of breath. I still had a difficult time exercising," she said. "And I think Dr. Rabbat had a suspicion that it was more than just my valve."

It was at this time that Dr. Rabbat ordered a coronary CT and HeartFlow fractional flow reserve computed tomography test (FFR_{CT}). FFR_{CT} offers greater accuracy in diagnosis than other more traditional non-invasive tests, but is less invasive than diagnostic assessments such as [invasive coronary angiography](#) in the cardiac catheterization lab. For these reasons, it is an ideal and increasingly preferred assessment when screening for [heart disease](#).

"It's really refining the overall diagnostic and patient experience," said Dr. Rabbat. "We're picking up disease that we've been missing with stress tests, and we're also able to safely avoid unnecessary invasive procedures in many patients who would otherwise have gone to the catheterization lab."

From a patient perspective, FFR_{CT} is similar to a conventional coronary CT where the patient lies in the center of the imaging system and undergoes a non-invasive scan. Once the CT is complete and has been interpreted, often FFR_{CT} is necessary as a second step to understand how blockages may be limiting [blood flow](#) to the heart. With FFR_{CT} , trained analysts apply tools informed by [advanced artificial intelligence](#) (AI) algorithms to create a 3D anatomical model of a person's heart, providing [quantitative data](#) about blood flow. These data help physicians visualize the blood flow, detect stenosis or plaque that obstructs blood

flow, and design treatment plans aided by information about the artery blockages beyond what can be gleaned from the CT alone.

Loyola Medicine, with Dr. Rabbat serving as the site Principal Investigator, was one of the highest enrolling sites in the United States for the PRECISE trial sponsored by HeartFlow. This clinical trial compared CT and FFR_{CT} with traditional invasive or non-invasive testing and showed that CT and FFR_{CT} significantly lowered the rates of false negative and false positives test results in patients with coronary artery disease. The PRECISE Trial was presented at the American Heart Association's November meeting.

The results of Moore's FFR_{CT} revealed blockages in an artery that were missed by the other tests she had undergone. During a procedure in the cardiac catheterization lab, the 90% blockage was confirmed and the HeartFlow imagery was used to pinpoint the best location for a stent.

Moore's experience demonstrates the importance of FFR_{CT} because even with diligent monitoring of her heart health, the standard-of-care testing missed the diagnosis. "If I hadn't had that test where the results were really clear, I could have fallen over dead," said Moore.

"It's really frightening to think what could have happened if Dr. Rabbat hadn't been paying so close attention to me; I could have had a heart attack." As the first hospital in Illinois to use the HeartFlow technology in 2015, Loyola has over eight years of experience in using FFR_{CT} and offers unique clinical expertise. This expertise was especially reassuring to Moore, who appreciates Loyola's status as a teaching hospital. "I really like the fact that Loyola is a teaching hospital because they're up on the latest techniques, the latest data, especially Dr. Rabbat. He's participated in research on HeartFlow.... I had never heard of it."

Use of FFR_{CT} as a [diagnostic tool](#) has become more widespread since

2021, when the American College of Cardiology and American Heart Association endorsed FFR_{CT} as a clinical pathway in its updated guidelines for chest pain evaluation and diagnosis. Dr. Rabbat's publications on FFR_{CT} were referenced in these guidelines, including Loyola University Medical Center's real-world experience demonstrating the safe deferral of unnecessary invasive procedures utilizing an FFR_{CT} pathway.

With this wider adoption, Dr. Rabbat hopes that it will be ultimately useful in helping detect heart disease in asymptomatic patients. "Right now it's mostly for symptomatic patients, but 40% to 50% of heart attacks occur in patients without any prior symptoms," he said. "We're missing a lot of patients waiting for symptoms. So I think that this technology will eventually be utilized as a screening modality in at-risk individuals once you're above a certain age."

Following a stent placement and cardiac rehabilitation, Moore's symptoms improved drastically and she feels fantastic. She's excited to partake in physical activities she couldn't do previously, such as snowshoeing in Colorado with her sisters, and she's looking forward to dancing at her son's wedding later this year. She credits Dr. Rabbat as well as everyone on the cardiac rehab team, particularly the cardiac nurses she works with. "I wouldn't be sitting here today if it wasn't for the cardiac team at Loyola...the care I received was not just kind, but technically extremely excellent. They take such good care of us, I feel 100% safe."

February is National Heart Month, and Dr. Rabbat views it as a reminder to take heart health seriously, especially among women, in whom heart disease often goes underdiagnosed. "Often cardiac disease presents differently in women than men," said Dr. Rabbat, citing symptoms other than chest pain as frequent indicators. "Even if you're having palpitations or nausea, lightheadedness, fatigue, jaw, neck, shoulder, arm, or upper

belly pain, these may be signs of [heart](#) disease and it may be a good indication to proceed with a CT." As Moore's case demonstrates, staying on top of [heart health](#) is critically important, both during Heart Month and year-round.

Provided by Loyola University Health System

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