

AI tools better at predicting heart transplant rejection than standard clinical method, finds study

February 15 2024



Credit: Emory University

More than 4,500 heart transplants were performed in the U.S. in 2023. While the lifesaving operation improves the quality of life and longevity

for most recipients, organ rejection remains a risk, with acute rejection occurring in up to 32% of recipients within the first year.

A team of researchers from Emory University, Case Western Reserve University and the University of Pennsylvania developed artificial intelligence tools to examine cardiac biopsy images to improve the prediction of rejection, helping to ensure patients receive the best possible post-transplant treatment.

Currently, clinicians rely on histologic grading of cardiac biopsies to diagnose [acute rejection](#). However, there are limitations to the method, which assigns International Society of Heart and Lung Transplantation (ISHLT) histologic grades corresponding to no, mild, moderate and severe rejection.

"The ISHLT grading criteria is qualitative, vague and lacks diagnostic accuracy," says Sara Arabyarmohammadi, Ph.D., assistant scientist at Emory University. "These limitations subject patients to considerable risk of receiving excessive or inadequate treatment and begs for an improved method to predict the patient's clinical outcome."

Arabyarmohammadi and her colleagues created a new method for automated, comprehensive analysis of heart biopsy images called the Cardiac Allograft Rejection Evaluator (CARE). Using AI tools, CARE extracts features associated with the shape, texture and spatial architecture of muscle cells, [immune cells](#) and stromal fiber in heart tissue specimen images to predict rejection outcomes for heart transplant patients.

"The ultimate goal is to provide pathologists and cardiologists with access to tools to help them make more informed and precise decisions regarding patients experiencing heart rejection," says Arabyarmohammadi. "This, in turn, facilitates the use of more

aggressive treatments for those in need, leading to more effective prevention of heart transplant failure."

The study of 2,900 patients, recently [published](#) in *Circulation: Heart Failure*, showed that the CARE model, optimized to predict cardiac rejection severity, was far better at assessing a patient's clinical outcome than an alternative model optimized to predict the ISHLT rejection grade.

"What is most interesting is not just that the AI approach was able to better predict transplant rejection compared to pathologic grade, but it used a set of image features that were far more intuitive and explainable compared to opaque, 'black box' AI models that are challenging for clinicians to interpret," says the study's senior author Anant Madabhushi, Ph.D.

More information: Sara Arabyarmohammadi et al, Failing to Make the Grade: Conventional Cardiac Allograft Rejection Grading Criteria Are Inadequate for Predicting Rejection Severity, *Circulation: Heart Failure* (2024). [DOI: 10.1161/CIRCHEARTFAILURE.123.010950](https://doi.org/10.1161/CIRCHEARTFAILURE.123.010950)

Provided by Emory University

Citation: AI tools better at predicting heart transplant rejection than standard clinical method, finds study (2024, February 15) retrieved 27 April 2024 from <https://medicalxpress.com/news/2024-02-ai-tools-heart-transplant-standard.html>

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