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Radiological Society of North America

820 Jorie Blvd
Oak Brook, IL 60523
TEL 1-630-571-2670
FAX 1-630-571-7837
RSNA.org

NEWS

RSNA Press Release

Artificial Intelligence Improves Heart Attack Risk Assessment

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OAK BROOK, Ill. — When used with a common heart scan, machine learning (ML), a type of artificial intelligence, does better than conventional risk models at predicting heart attacks and other cardiac events, according to a study published in the journal *Radiology*.

Heart disease is the leading cause of death for both men and women in the United States. Accurate risk assessment is crucial for early interventions including diet, exercise and drugs like cholesterol-lowering statins. However, risk determination is an imperfect science, and popular existing models like the Framingham Risk Score have limitations, as they don't directly consider the condition of the coronary arteries.

At A Glance

- Machine learning (ML) does better than conventional risk models at predicting heart attacks and other cardiac events.
- Researchers compared the ML approach to other vessel scoring systems in almost 6,900 patients.
- The ML approach better discriminated which patients would go on to have a cardiac event from those who would not.

Kevin M. Johnson, M.D.

Coronary computed tomography arteriography (CCTA), a kind of CT that gives highly detailed images of the heart vessels, is a promising tool for refining risk assessment—so promising that a multidisciplinary working group recently introduced a scoring system for summarizing CCTA results. The decision-making tool, known as the coronary artery

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disease reporting and data system (CAD-RADS), emphasizes stenoses, or blockages and narrowing in the coronary arteries. While CAD-RADS is an important and useful development in the management of cardiac patients, its focus on stenoses may leave out important information about the arteries, according to study lead author Kevin M. Johnson, M.D., associate professor of radiology and biomedical imaging at the Yale School of Medicine in New Haven, Conn.

Noting that CCTA shows more than just stenoses, Dr. Johnson recently investigated an ML system capable of mining the myriad details in these images for a more comprehensive prognostic picture.

“Starting from the ground up, I took imaging features from the coronary CT,” he said. “Each patient had 64 of these features and I fed them into a machine learning algorithm. The algorithm is able to pull out the patterns in the data and predict that patients with certain patterns are more likely to have an adverse event like a heart attack than patients with other patterns.”

For the study, Dr. Johnson and colleagues compared the ML approach with CAD-RADS and other vessel scoring systems in 6,892 patients. They followed the patients for an average of nine years after CCTA. There were 380 deaths from all causes, including 70 from coronary artery disease. In addition, 43 patients reported heart attacks.

Compared to CAD-RADS and other scores, the ML approach better discriminated which patients would have a cardiac event from those who would not. When deciding whether to start statins, the ML score ensured that 93 percent of patients with events would receive the drug, compared with only 69 percent if CAD-RADS were relied on.

“The risk estimate that you get from doing the machine learning version of the model is more accurate than the risk estimate you’re going to get if you rely on CAD-RADS,” Dr. Johnson said. “Both methods perform better than just using the Framingham risk estimate. This shows the value of looking at the coronary arteries to better estimate people’s risk.”

If machine learning can improve vessel scoring, it would enhance the contribution of noninvasive imaging to cardiovascular risk assessment. Additionally, the ML-derived vessel scores could be combined with non-imaging risk factors such as age, gender, hypertension and smoking to develop more comprehensive risk models. This would benefit both physicians and patients.

“Once you use a tool like this to help see that someone’s at risk, then you can get the person on statins or get their glucose under control, get them off smoking, get their hypertension controlled, because those are the big, modifiable risk factors,” he said.

Dr. Johnson is currently working on a paper that takes results from this study and folds them into the bigger picture with non-imaging risk factors.

“If you add people’s ages and particulars like smoking, diabetes and hypertension, that should increase the overall power of the method and improve the overall results,” he said.

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“Scoring of Coronary Artery Disease Characteristics on Coronary CT Angiograms by Using Machine Learning.” Collaborating with Dr. Johnson were Hilary E. Johnson, B.A., Yang Zhao,

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Ph.D., David A. Dowe, M.D., and Lawrence H. Staib, Ph.D.

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