Bracelet sensor assesses troponin levels to aid heart attack diagnosis

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An experimental wrist-worn device was found to predict troponin-I and obstructed arteries with 90% accuracy in five minutes, according to research presented at the American College of Cardiology's Annual

Scientific Session Together With the World Congress of Cardiology.

The study is the first multicenter trial to assess a wearable troponin sensor in a real-world clinical context. Troponin-I, a protein that enters the bloodstream when the heart muscle becomes damaged, is commonly assessed via a blood draw as part of routine processes for diagnosing a heart attack. According to researchers, the new wearable sensor could help augment that diagnostic process by providing an early assessment of the likelihood that a patient is having a heart attack before lab results are available.

"This is an exciting opportunity because it increases our capability for early diagnosis of heart attacks in both community settings and in acute care environments," said Partho P. Sengupta, MD, professor of cardiology at Rutgers Robert Wood Johnson Medical School in New Brunswick, New Jersey, chief of the cardiovascular service line at Robert Wood Johnson University Hospital and the study's lead author. "There's still a lot of work to be done, but this approach could potentially address access issues and prioritization issues, for example by shortening the time to triage or being used by emergency responders to plan the patient's journey before they even arrive at the hospital."

A heart attack occurs when the arteries that supply blood to the heart become blocked, limiting the supply of oxygen to the heart and the rest of the body. People experiencing heart attack symptoms such as chest pain or shortness of breath are advised to immediately go to a hospital emergency room where clinicians can diagnose a heart attack and act quickly to open blocked arteries if needed.

In many emergency rooms, high volumes of patients combined with a shortage of personnel can make it challenging to rapidly determine which patients are suffering a heart attack and which are not. A blood test to check for troponin is typically used when a patient has chest pain

but does not show definitive signs of a heart attack on an electrocardiogram. However, the process of drawing blood and sending the sample for lab analysis can take time, potentially allowing heart damage to worsen while clinicians wait for a diagnosis.

The wrist-worn sensor uses infrared light to detect the presence of a type of troponin called troponin-I in the blood through the skin. The device sends signals via Bluetooth to a cloud-based system, where a machine learning algorithm relates the information to training data to predict the wearer's troponin level.

For the trial, researchers enrolled 239 patients who were suspected of experiencing a heart attack at five sites in India. All patients wore the wrist-based sensor and underwent a blood draw to assess troponin-I levels, an electrocardiogram to record the heart's electrical signals, and either an echocardiogram or coronary angiogram to image blood flow through the heart. The researchers used data from the first three sites to train the machine learning model and then used the remaining two sites to test the model's accuracy.

The results indicate that the system predicts troponin-I levels with about 90% accuracy. In addition, the findings correlated well with clinical evidence of a heart attack; people with abnormal troponin levels as measured by the device were about four times as likely to have an obstructed artery compared to people with a negative troponin result as measured by the device.

"With this level of accuracy, if you use this device and it comes out positive, you're fairly sure this patient can be admitted for fast tracking diagnostic tests, treatment and intervention," Sengupta said.

Researchers cautioned that more studies are needed to further validate and refine the system, including studies to determine whether biological

variability—such as differences in skin tone, wrist size, skin health or other factors—could affect the device's performance. In addition, they plan to study whether including the detected troponin value (rather than simply the presence or absence of a threshold value) or providing continuous measurements could enhance the device's usefulness in clinical settings.

The patients included in the trial were hospitalized but were not being treated in the emergency room. Researchers said testing the device in emergency room settings would be helpful moving forward. They added that the wearable sensor technology could potentially be adapted for aiding triage and diagnosis for a variety of cardiovascular diseases and other health problems.

"Transdermal infrared-based techniques open up a tremendous potential for bloodless biomarker assessment," Sengupta said. "We have started with troponin, but the journey is going to continue because it is possible to use this technology for other biomarkers. This is just the start."

Provided by American College of Cardiology

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