"All the News That's Fit to Print"

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Today: Limited sun near Lake Erie. Mostly cloudy elsewhere. Rain by this afternoon in Ohio and western Pennsylvania. Highs will be mainly in the 60's. Weather map on Page C16.

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WHAT'S NEXT

Beyond the EKG, to a Hypersensitive Heart Monitor

By ANNE EISENBERG

THE familiar electrocardiograms of yearly medical checkups are the routine way to record electrical activity of the heart and detect disorders in its rhythms. But the test is relatively insensitive at pinpointing small areas where there may be problems, sin!,:e a standard EKG machine s.amples electrical potential only at a handful of points on the body's surface.

But a new computer-based method developed by a researcher seeks to deliver far more detailed information about the electrical activity of the heart. Instead of a dozen or so electrodes, the technique uses 224 of them, all woven into a chain mail-like vest worn by the patient. The electrode-based recordings are then combined with computerized X-rays taken at the same time.

Algorithms process the data to map the electrical impulses of the heart as they travel through the muscle, revealing the places where cardiac rhythms go awry.

The technique, called electrocardiographic imaging, provides a close approximation of the electrical measurements obtained when doctors thread catheters through the body to the heart and assess electrical activity there directly.

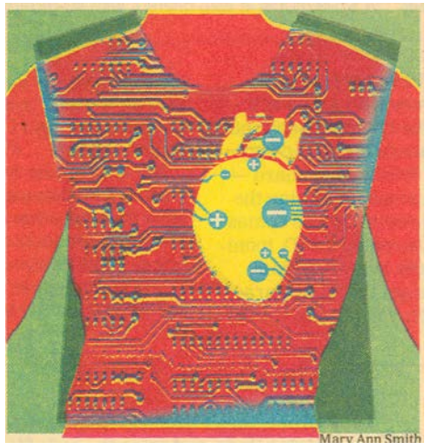
Yoram Rudy, a professor of biomedical engineering at Case Western Reserve University, has developed the method over 20 years. Using the imaging system, he said, "we have noninvasively reconstructed and located initiatiop sites of arrhythmic activity in the heart with an accuracy of 10 millimeters or better." Normally, he said, detailed information on such activity could be obtained only by putting electrodes in direct contact with the heart.

In the technique, the patient slips on the vest for simultaneous recording. Multiple X-rays are also taken by computer tomography or CT, a technique used to construct three-dimensional images of the heart. Mathematical programs then reconstruct the heart's electrical activities by using the information from the X-rays and the electrocardiograms.

The new method is still in need of validation; ihe vest used by Dr. Rudy is a prototype, and much clinical testing lies ahead. But when it becomes available, it may offer many advantages. "Dr. Rudy's technique is able to determine the electrical activation of the heart from signals on the body surface," said Dr. William Gregory Stevenson, who directs the clinical cardiac electrophysiology program at Brigham and Women's Hospital in Boston. It is much more accurate than the typical EKG, he said, and yields more information about what's going on in the heart.

Dr. Rudy and his group recently reported their first use of the method on human subjects in this month's issue of the journal Nature Medicine.

The procedure may one day be useful in helping to identify patients at high risk of life-threatening arrhythmias before a catastrophic



incident. Sudden death is the most serious consequence of such arrhythmias, said David A. Lathrop, who leads the arrhythmia and ischemia group at the National Heart, Lung and Blood Institute, which has financed Dr. Rudy's research.

There are about 250,000 cases of sudden cardiac death in the United States each year, Dr. Lathrop said, about 70 percent of them from disturbances in the lower chambers of the heart, the ventricles.

"There's not much warning," he said. Sudden cardiac death occurs within an hour of symptoms like tightness of the chest. Sometimes there are no warning signs at all.

Dr. Rudy's method may one day permit improved images of the electrical status of the heart, Dr. Lathrop said, and identify individuals at risk well before the event.

"The problem of sudden death is very real," said Dr. Douglas P. Zipes, head of the division of cardiology at Indiana University School of Medicine and a past president of the American College of Cardiology. "Prob

With the aid of X-rays and a data cruncher, an electrodestudded vest pinpoints trouble.

ably it is due to minute changes in the electrical activity of the heart which we haven't been able to measure and are consequently inept at predicting accurately."

Applications like Dr. Rudy's "may help us establish who is in danger," Dr. Zipes said.

The new method may be llseful not only for diagnosis, but also as an adjunct. to surgery, for example in pinpointing sites of arrhythmia for a procedure called catheter ablation in which tubes are inserted into the heart.

In catheter ablation, the area of the heart causing fast rhythms may be burned away or ablated with a high-frequency electric current. "But to do the catheter ablation," said Dr. Stevenson of Brigham and Women's, "you have to find precisely the region of the heart that is causing the problem."

Ablation for cardiac arrhythmia is an area that has evolved rapidly since the 1990's, Dr. Stevenson said. Initially applied only to select types of heart rhythm problems, it~ use has recently expanded. "We've become better at correcting arrhythmias that are more difficult to diagnose and treat," he said, including som~ ventricular arrhythmias that are life-threatening and are often related to an area of scar tissue left by a heart attack.

Dr. Stevenson said he hoped that the new method of defining cardiac electrical activation from the body's surface would make the catheter procedure even more effective. "It should help in selecting people who can be cured with ablation," he said, "and help guide ablation itself by improving our estimated location of the site that needs to be ablated."

Using catheters to locate the exact area of arrhythmias can now take several hours, said Dr. David J. Wilber, a professor of medicine and director of cardiology at Loyola University Medical Center in Maywood, Ill.

Typically physicians put multiple catheters inside the heart, each with four to 10 electrodes attached to the spaghetti-like tubes. With the new method, he said, a computer monitor displays the data gathered by electrocardiograms and computer tomogra phy as though doctors were actually looking " into the chest cavity.

"The display comes' up as if the signal were coming from the heart surface itself," Dr. Wilber said. "It's like you had the chest open and were recording electrical activity from the surface of the heart."

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