Professor helps build heart scanner

A UNL engineering professor is adapting the technologies which produced the "body scanner" to diagnosis of ailments of the heart.

The goal is an instrument, combining computers and radiology, which can provide an "inside" look at a beating heart.

A local member of the research team working to give physicians this new edge is Y.C. Pao, UNL professor of engineering mechanics.

His tool is the computer, an instrument which is becoming one of the medical profession's best friends. As part of a research team associated with the Biodynamic Research Laboratory of the Mayo Clinic and Mayo Foundation of Rochester, Minn., he is contributing to the development of a new X-ray device which may prove of great value in coronary care.

With it, cross-sectional views of the heart can be recreated and then analyzed for abnormalities.

Computer models

Pao's part is to develop computer models which will transform the X-ray images into meaningful information, accurately reflecting the dynamics of the heart in action and disclosing stresses and strains common to heart ailments, diseases and irregularities.

Since his association began with the Biodynamics Laboratory in 1973, Pao has received $180,000 in research money from the National Institute of Health, including $40,000 this year to expand the study into the area of lung dynamics. He is now in the fourth of the five-year heart study and the first of two years of research on the lungs.

"From an engineering point of view, the heart is a structure," Pao says. "Instead of studying a hard material like concrete or metal, however, I'm looking at soft tissue."

The problem involves a combination of highly sophisticated medical, engineering and computer techniques. He has studied all three during the course of his research.

Scanners not new

The idea of X-ray body scanners is not new, but their development has depended on the formulation of computer programs to analyze and reconstruct the images. Today, many hospitals throughout the country are using such scanners for brain and other organ diagnoses.

But the heart poses special problems. "Currently available commercial body scanners are suitable only for examining the cross-sections of stationary organs such as the brain or liver," Pao explains, "But not for those of moving organs such as a beating heart or breathing lung."

The explanation lies in the scanner procedures. During a normal X-ray scan, a single X-ray source is rotated around the patient to make projections through the body from various angles. Unlike a typical X-ray in which the image is projected on photographic plates, the several scanner images are fed directly into a computer where they are combined into a cross-section within a matter of minutes.

But trying to do the same thing with the heart is much like trying to take a 360-degree photograph of a runner in mid-stride. It can't be done with one camera alone.

Solving motion problem

To solve this motion problem, the Mayo team is constructing a "28-X-ray scanner" which will allow 28 individual X-ray images to be projected at once, enough for the computer to reconstruct a finely detailed cross-section. Use of the scanner in actual clinical tests is expected in mid-1979, Pao says. Before that can happen, however, this work is essential in developing the models that will insure the machine's accuracy.

To begin, Pao had to determine how the computered reconstructed heart cross-sections compared with actual cross-sections. For this, he compiled data from canine studies conducted at the Rochester facilities.

Hearts from test animals were removed and kept alive artifically as they underwent the scanning process. A standard, single-source scanner was used, but in this case, the heart not the scanner was rotated.

A computer which maintained the heart rate and rhythm by means of attached electrodes also triggered the

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