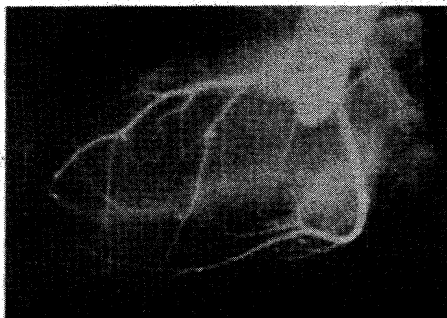


Internal Heart Functions Are Mon

Precise and continuous monitoring of the heart's internal functioning, without discomfort to the patient, has been made possible by a technique that establishes mapping points in the heart muscle, then records their subsequent changes



Tantalum coils (below) are implanted in heart (above) at points selected for measurement of heart size and movement. Coils are 1/16 inch long (common pin is shown for comparison), and shaped from a nonreactive metal that will last indefinitely without affecting the heart muscle. X-rays of the heart, taken in short sequences, are recorded on a video disk that can store high-resolution images and play them back on a TV screen at various speeds or as still pictures. Comparison of the positions of the coil-markers in early images with those in x-rays taken later provides data with which cardiac function can be measured precisely and routinely.



of position by x-rays shown via "instant replay" on a TV screen.

The new technique is being used at the Stanford University Medical Center to follow the progress of patients after they have undergone surgery for heart transplants, coronary artery bypass graft, or valve replacement. Within an hour after x-rays are taken, physicians can determine how well each segment of the heart is working, how much blood the heart contains, how much blood it is pumping, and the length of contraction time.

The first step in the system is taken while the patient is on the operating table: the surgeon implants minute metal coils at appropriate places in the muscle fiber. The coils are made of tantalum, a non-reactive substance that can last a lifetime.

Later, x-rays taken in 3-second sequences are recorded on a video disk—a magnetized, coated, 14-inch aluminum disk that can store high-resolution images and replay them at normal speed, in slow-motion, in reverse, or one frame at a time. Pulsed signals from angiograms also can be played repeatedly, making them available for prolonged analysis when a computer is linked to the disk.

By comparing sets of x-rays with those taken later, researchers can determine if the heart is getting larger or smaller. They can also discover whether a transplanted heart is undergoing rejection, and how fast the heart is deteriorating or improving.

In addition, the technique will be used to study the short-term recovery process after surgery, to investigate the effects of drugs and exercise on the hearts of patients, and to examine the mechanisms by which the rejection process and anti-rejection drugs affect the transplanted heart.

The system has been employed with considerable success for about two years on more than 50 heart-transplant, coronary artery-bypass, and valve-replacement patients at Stanford University Hospital, by a research team composed of Dr. Neil Ingels and engineer George Daughters of the Palo Alto Medical Research Foundation, and Drs. Edward Stinson, Edwin Alderman, Lewis Wexler, Philip Oyer, Randall Griep, Jack Copeland, and Norman Shumway of Stanford.

The video disk, but not necessarily the metal coils, are also used to analyze the blood-pumping efficiency of hearts of patients in the Mayo Clinic's cardiovascular research ward. □