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Condensed from
30 Years Ago:

Measurement of Pericardial Fluid Correlated with the Iodine-131-Cholografin® and IHSA Heart Scan

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Since its introduction, the radioisotope heart scan has become established as a safe, simple, and useful technique for the diagnosis of pericardial effusion. Nevertheless, few studies have been reported concerning quantitative aspects of the method. It was proposed that a preoperative heart scan be performed and the pericardial contents aspirated and measured in all such patients, and that criteria for heart scanning be established from these figures.

To date, 23 operated patients have been so studied. In addition, data was available from postmortem examination in six other patients, and five patients with pericardial effusion underwent diagnostic pericardiocentesis. An additional three patients had massive pericardial effusions but were not tapped; these patients are also included in the series.

Iodinated human serum albumin-I^{131} (IHSA) in doses of 4-6 μCi/kg was employed as the scanning agent, as in the original investigations. Since April, 1961, we have employed I^{131}-Cholografin® and at present it is used exclusively.

Iodius-131-Cholografin is extracted from the blood by the polygonal cells of the liver and is then excreted into the biliary tree. The rate of extraction is such that 50% of the initial blood concentration disappears within 4.8 hr (if 0.25 mg Cholografin is injected). The scan is begun 15 min after injection at the sternal notch and proceeds caudally, so that by the time the liver is reached (40-60 min) about 10%-15% of the Cholografin has been removed from the blood. Satisfactory scans have been obtained with doses of I^{131}-Cholografin of 3-7 μCi/kg and scan speeds of 16-18 cm/min. Nonradioactive iodine is administered orally several hours prior to scanning to block the thyroid uptake.

The instrument used for this study was the Picker Magnascanner, which is equipped with a 3 × 2-inch NaI(TA) crystal and pulse-height analyzer. The maximum count rate varied somewhat with the dose, blood volume, cardiac size and geometry, but was approximately between 6 and 15 cpm/μCi (1800-6000 cpm).

The scan was displayed both on Teledeltos paper and on clear x-ray film, but only the latter was used for diagnostic purposes (photoscan). Localizing marks were made in the midclavicular lines at approximately the fourth intercostal space and recorded on the photoscan. Lead shots were then placed on the skin marks and two successive exposures made of the chest at a 6-foot distance in the AP projection, the central ray passing through the lead markers alternately.

The photoscan was then accurately superimposed on the roentgenogram and the maximum transverse cardiac diameters measured. Comparison of these parameters proved to be the best criterion of pericardial effusion.

Of the 37 patients, 13 had pericardial effusions of 200 cc or more. The other 24 patients all had severe cardiac disability, with hypertrophy and/or dilatation of one or more chambers. These latter patients, with effusions of 100 cc or less, were compared with the group of 13.

In the 24 patients with cardiac hypertrophy and/or dilatation with 100 cc or less of pericardial fluid, the mean difference between the maximum transverse cardiac diameters on scan and x-ray was 2.1 cm and was always less than 3.5 cm. The ratio of the two diameters was always greater than 0.80.

There were 13 patients with pericardial effusions of 200 cc or greater and in 11 of these, the difference between the maximum transverse cardiac diameters of scan and x-ray was greater than 4.5 cm. The ratio of the diameters in every case was less than 0.80 (mean 0.69).

With marked pericardial effusion (Fig. 1b) a nonradioactive zone visibly surrounds the cardiac blood pool, and separation from the pulmonary vasculature and from the liver can be demonstrated. These changes are more obvious when the scan is seen without superimposition on x-ray.

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Three patients were found to have effusions of between 200 and 300 cc, and in two of these three patients the diagnostic criteria for pericardial effusion were not completely satisfied. Thus in the presence of cardiomegaly, a 200-cc effusion may not widen the x-ray silhouette enough to satisfy all the criteria for effusion which we have established.

It is apparent, therefore, that in patients with effusions of 200–300 cc, a diagnosis of pericardial effusion by radioisotope scanning will depend upon the size of the heart.

The results of this study indicated that pericardial effusions of more than 300 cc can be diagnosed accurately by radioisotope scanning, and notably in those patients without cardiomegaly, as little as 200 cc may be detected.The lateral border of the heart is never sharp for a variety of reasons: constant motion of the heart; respiration; collimator resolution. One important factor contributing to this problem is scatter from the high-energy gammas produced by I^{131} in its decay. Better cardiac scans could be attained by use of monoenergetic, lower-energy radioisotopes.

In 23 patients undergoing open-heart surgery in whom the pericardial contents were accurately measured, and in 11 additional patients examined at autopsy or by pericardiocentesis, isotopic photoscans of the heart were made and the results were correlated.

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Condensed from *15 Years Ago:*

"Circumferential Profiles:" A New Method for Computer Analysis of Thallium-201 Myocardial Perfusion Images

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A method for computer analysis of thallium-201 scintigrams is described, in which the left ventricular activity is measured along radii constructed from the center of the left ventricle (LV) to each point on the LV circumference. Data are then displayed graphically as a "circumferential profile" of normalized activity against radial location. Thallium defects are identified and scored by comparison of the profile curve with empirically determined normal limits. In patients with coronary artery disease, defect scores were found to be quantitative and reproducible, and to agree generally with subjective visual analysis.

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