Radionuclide Imaging of Acute Myocardial Infarction with Tc-99m (Sn)-Diphosphonate (EHDP)

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Tc-99m EHDP was utilized for myocardial imaging in 8 patients with chest pains. All 7 patients with clinical, electrocardiographic and enzymatic evidences of acute myocardial infarction had positive myocardial scintigrams. But one of the patients who had repeated scintigrams on the 30th post-infarction day had negative scintigrams.

If the scintigrams are obtained druing the 4th to 6th days of post-infarction, the size of positive image is related to the degree of infarction size with occasional reduced activity in the central area. This "doughnut" appearance of Tc-99m EHDP was well vizualized in one of our patients who suffered from extensive, acute myocardial infarction, and was also seen by our study on animal models. T1-201 was not incorporated into ischemic or infarcted areas, and this radionuclide only vizualized non-ischemic areas. In contrast, Tc-99m EHDP was taken up into the ischemic and infarcted areas, predominantly into the peri-infarction zone with resultant imazing of "doughnut" appearance.

In patients with significant ischemia but without infarction failed to show positive scintigrams and was helpful to rule out infarction in one of our patients.

Myocardial imaging with Tc-99m EHDP is simple, safe and reliable method to detect and to localize acute myocardial infarction if performed within 1 week after infarction, and is helpful to estimate the infarction size.

Myocardial Perfusion Scanning by Using Rb-81 and/or Tl-201

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For the detection of regional myocardial perfusion abnormality noninvasively, myocardial scintiscannings were performed at rest and exercise, by using Rb-81 or Tl-201.

Myocardial imaging by Rb-81 was performed using a scintillation camera (Pho/Gamma-HP) equipped with a pinhole collimator and specially constructed lead shield, which was required because of high energy gamma emission from the Rb-81. Without lead shield, image resolution was inadequate, whereas with the shield (especially 5 cm thick) images of diagnostic quality were obtained.

Images taken with 511 KeV photon peak and with 190 KeV photon peak were compared, and the former showed better image resolution.

Myocardial imaging by Tl-201 was performed by Pho/Gamma-HP scintillation camera equipped with 15000 pararell hole high resolution collimator.

Scintigrams were obtained in anterior, LAO and left lateral position at sitting in Rb-81 and at supine in Tl-201.

For exercise studies, patients underwent a graded ergometer exercise stress test under continuous Ecg monitroing. Patients exercised to the point of positive ST-change or 85% of predicted maximal heart rate, at which time tracer was administered intravenously. Exercise was continued additional one minute.

In normals, myocardial images showed horseshoe or 0-shaped appearance and concentration of tracer was relatively uniform throughout myocardium.

In all transmural myocardial infarctions (14 patients), regional perfusion defects (cold spot) were detected, and their locations correlated well

with sites of abnormal Q-waves in Ecg.

Exercise stress Ecg and stress scintigrams were performed in 20 patients. Myocardial perfusion defects developed by stress were detected in 5 of 6 definite positive exercise Ecg patients, 2 of 4 borderline exercise Ecg patients and 2 of 10 negative exercise Ecg patients. These 2 patients (exercise Ecg: negative, stress scintigram:positive) had typical angina.

These scintigraphic methods appear to be excellent for detection of coronary heart disease noninvasively.

Myocardial Scintigram with Rb-81 and Its Application to Regional Myocardial Perfusion Study

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Recently Rb-81 produced in a commercial cyclotron became available. Rubidium-81 decays with a half life of 4.6 hrs to Kr-81 m, emitting 446 KeV and 511 KeV gamma ray, and Kr-81 m decays with a half life of 13 sec to Kr-81, emitting 190 KeV gamma ray. These characteristics are very interesting for the application of the nuclide to the myocardial perfusion study because Rb-81 distributes in the myocardium, like pottasium, after intravenous administration, and changes slowly, whereas its daughter Kr-81 m, being inert gas, mixes uniformly with tissue and removes from it at a rate dependent on the myocardial perfusion. Thus a quantification of myocardial perfusion rate can be made by comparing the separately measured activity of Rb-81 with that of Kr-81m.

In this study, 12 cases of myocardial infarction, 7 cases of angina pectoris and 7 normal subjects were injected intravenously 3–4 mCi of ^{81}Rb chloride.

The radioactivities were measured by a scintillation camera with a pinhole collimetor covered with a specially designed lead shield of 5 cm thickness.

Myocardial images were obtained by both photon peak of 511 KeV and 190 KeV for Rb-81 and Kr-81m respectively in three views (AP, LAO, 1-LAT). And data obtained with the scintillation camera stored onto a magnetic tape of an on-line minicomputer system.

In a preliminary study, the ratio Rb/Kr in the whole myocardium were calculated. In most cases of myocardial infarction, the ratio were lower, but there were significant difference between cases of angina pectoris in asymptomatic state and normal subjects. After the measurements of the ratios at rest, some cases were sublingualy 0.8 mg nitroglycerin and after 3 min the measurement of ratio were repeated. In normal subejcts, slight decrease of ratio were shown, but in cases of myocardial infarction, marked decrease of the ratio at the infarcted region were observed.

It was suggested that the ratio of Rb/Kr was useful for the estimation of regional myocardial flow rate and also useful for the evaluation of the local responsibility to various agents.

Myocardial Scintigraphy with Rb-81 and Tl-201

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Several authors have reported on scintigrams with Rb-81 by a positron camera or gammacamera covered with thick lead-shielding on collimator because of its high energy photons.

The purpose of this study is to obtain myocardial scintigrams with Rb-81 using a computeri-