

The Measurement of Regional Myocardial Perfusion Rate Using the Rb/Kr Ratio

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Rubidium-81 decays with a half life of 4.6 hrs to Kr-81m, emitting 446KeV and 511KeV gamma rays, and Kr-81m decays with a half life of 13 sec to Kr-81, emitting 190KeV gamma rays.

When Rb-81 is distributed in the myocardium, its daughter Kr-81m, being inert gas, diffuses uniformly in the tissue and disappears from it at a rate dependent on the tissue perfusion. Thus the ratio of radioactivities of Rb-81 to Kr-81m can be adopted as an indicator of the myocardial perfusion rate.

The radioactivities (in 511KeV and 190KeV) were obtained by a scintillation camera with a pinhole collimator covered by a special shielding.

In preliminary, the perfusion study was applied on the forearms at rest, at a state of taking a tourniquet in the upper arm and during exercise by handgrip immediately after taking off the tourniquet. Comparing with the ratio at rest, the ratio decreased slightly in a condition of taking tourniquet, and increased during exercise.

The myocardial studies were done in 15 various heart diseases at rest, after exercise (bicycle ergometer) and after sublingual administration of nitroglycerin. And regional perfusion rates were displayed in an image of values of Rb/Kr ratios.

In cases of hypertrophic cardiomyopathy, the ratio increased after exercise. In cases of myocardial infarction, the ratio in the lesions were a smaller than the surrounding area.

In angina pectoris, a case with ST depression during exercise, the ratio did not increase by exercise, but in other case without the ECG abnormality, the ratio increased by exercise.

After nitroglycerin administration, the ratio for whole myocardium decreased significantly in 7 cases, and did not change in 7 cases, but in a case the ratio increased.

In summary, this method of mapping the regional myocardial perfusion rate proved to be useful for the evaluation of the changes of flow rate in various pathophysiological state.

Clinical Studies of Myocardial Scintigraphy (I)

—Study in the Measurement of Myocardial Blood Flow—

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Thallium-201 myocardial scintiphotography was performed in 10 cases of normal control, 21 patients with myocardial infarction and 8 with angina pectoris. The patients were given intravenous injection of 1.0-2.0mCi of Thallium-201, and scintiphotos were obtained from four different views (anterior, left lateral, 30 and 45 degree left anterior oblique). The images were obtained during 5 to 45 minutes after the injection with a Toshiba

gammacamera GCA-202 on the energy spectrum of $80\text{KeV} \pm 35\%$. There was a good agreement of the location of infarction between the results of ECG and scintiphotography. Soon after the injection of Thallium-201, serial images including whole chest were taken one frame in each one second during 30 seconds, and total injected dose was calculated from the maximum radioactivity. Myocardial uptake was calculated by the scinti-