MYOCARDIAL PERFUSION IMAGING WITH THALLIUM-201--QUANTIFICATION AND ITS CLINICAL APPLICATIONS---

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The purpose of this investigation is the basic study of quantitative Tl myocardial imaging and its clinical applications.

Scintigrams were obtained with a Anger camera interfaced to a minicomputer. Myocardial Tl uptake index was computed as a ratio of total injected Tl activities to Tl activities at the various parts of background subtracted myocardial images. In basic study, coronary arteries of eight dogs were ligated then Tl was injected intravenously and Tc-microspheres were injected into the left atrium. In four young athletes, myocardial images were obtained at rest and at various exercise levels. In patients with coronary artery disease, exercise stress and nitroglycerin (NTG) loaded myocardial images were obtained.

In eight dogs, the distribution of microspheres was correlated well with myocardial Tl distribution (mean correlation coefficient 0.93) as well as Tl uptake index obtained by scintigraphy (mean correlation coefficient 0.88).

In four atheletes, there were linear relations between Tl uptake indices and double products. These indicated that the Tl uptake index reflected myocardial perfusion in ischemia as well as increased coronary flow which commensurated with the increment of oxygen demand.

By using the Tl uptake indices together with myocardial images, we are able to increase the diagnostic accuracy of exercise stress imaging, especially in cases with triple vessel disease. Furthermore, we are able to detect NTG induced myocardial perfusion changes precisely.

Our present study suggested that changes of the Tl uptake indices reflected regional myocardial perfusion changes quantitatively and clinical applications of the Tl uptake indices were valuable.

QUANTITATIVE ASSESSMENT OF Tl-201 MYOCARDIAL SCINTIGRAPHY WITH EXERCISE LOADING

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While Tl-201 has been established as a useful myocardial perfusion imaging agent, we attempted to quantify its uptake process by the myocardium to establish a method for myocardial blood flow (MBF) measurement with or without exercise loading by bicycle ergometer.

After intravenous injection of a bolus of Tl-201, its rapid transport process were recorded during the initial 5 minutes by a scintillation camera and a data processing system. Total injected dosage (A) were obtained from the counts during the initial passage through the heart and lung, and myocardial uptake (B) were counted with the same geometry from the subsequent accumulation to the myocardium with subtraction of the background activities in the upper mediastinal region. The ratio of B/A is assumed to be proportional to the fractional MBF to cardiac output (MBF/CO) according to the indicator fractionation principle. 10 normals (N), 9 with insignificant (<70% stenosis) coronary artery disease (CAD I), 13 with significant ($\geq$70% stenosis) coronary artery disease (CAD II), and 11 with hypertrophic cardiomyopathy (HCM) with normal coronary arteriogram were included in this study. All subjects were reexamined two weeks later with submaximum exercise loading by bicycle ergometer.

The values of MBF/CO at rest were 3.36±0.49 (N), 3.84±0.97 (CAD I), 4.49±1.24 (CAD II), and 5.99±1.03 (HCM). There was a positive correlation between this absolute value of resting MBF/CO and left ventricular mass determined by echocardiography, which represented that MBF/CO is a function of MBF and myocardial mass. The change ratio of pre- and post-exercise values (ΔMBF/CO) were 1.75±0.11 (N), 1.33±0.16 (CAD I), and 1.05±0.19 (CAD II). MBF/CO showed the significant increment in N corresponding to the increment of cardiac work, whereas not increased in CAD II. This fact indicates the failure of the myocardial blood supply to the increased demand of the myocardium. ΔMBF/CO revealed superior to the simple stress myocardial perfusion imaging.