maximum muscle volume were different in each area of left ventricular wall, free wall, apex & septum, in the myocardial infarction. On the other hand such an asynchrony was not observed in normal case.

In conclusion, non-traumatic analysis of detailed left ventricular functions showed good promise in the daily care of patients and, further, sophisticated analysis of cardiac funcion of the healthy and the diseased.

Myocardial Scintigraphy with 201-T1 and Quantitative Assessment of Myocardial Blood Flow

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A newly introduced radionuclide for myocardial imaging, 201-T1, is ideal for scintillation camera imaging of its proper energy, which is different in this respect from a series of potassium analog such as 43-K and 86-Rb. Since T1 moves into cells with high extraction efficiency from blood stream rapidly following an intravenous administration, distribution of this tracer represents blood flow distribution throughout the body like other potassium analogs. Ischemic regions, if present, can thus be shown as decreased uptake of 201-T1 or cold area. This paper presents (1) our experience of myocardial imaging with 201-T1 and (2) an attempt to quantify myocardial blood flow (MBF) with and without exercise loading.

46 subjects consisting of 11 normals, 17 with ischemic heart disease (IHD) including 14 with old myocardial infarction (MI), 6 with hypertrophic cardiomyopathy (HCM) and the remainder with various diseases. A bolus of 201-T1 as thallous chloride in 2.0 mCi were injected intravenously and its rapid transport through the central circulatory system and its subsequent process during initial 3 minutes were recorded by scintillation camera with diverging collimator so as to include whole chest and stored into direct playback system to be analyzed further. Then anterior (ANT), left anterior (LAO) and left lateral (1-LAT) myocardial imaing were studied using parallel hole high resolution collimator. 69–83 Kev of gamma spectrum was selected. Exercise loading was done using bicycle ergometer during 7–15 minutes of 100–300 watts/sec, simultaneously monitored by ECG.

Quantification of MBF was accomplished using the recording the rapid transport phase according to the indicator fractionation principles (Ishii et al, Cir Res 33: 113, 1973), as expressed in the following equation

$$MBF/CO = B/A$$

, where the fractional blood flow of the cardiac output (MBF/CO) is equated with the fraction of the myocardial activity (B) to the activity of total injected dosis (A) initially transit through the central circulatory system both in the term of the scintillation camera recording.

Normal myocardial scintigraphy revealed predominat visualization of left ventricular wall as well as septum, whereas in the case with right ventricular hypertrophy such as tetralogy of Fallot and cor pulmonale, right ventricular wall was well visualized. In 5 of 6 cases with HCM, asymmetric hypertrophy of myocardial mass was recognized. In 13 of 14 cases with established myocardial infarction, defects on scintigraphic image was recognized in the region well comformed with ECG findings. MBF/CO was calculated in all cases. Mean value of normals was 4.40 ± 0.52 %, that of IHD was 4.25 ± 0.82 % and of HCM was 5.80 ± 1.46 %. There was no significant difference between these groups. However, on exercise loading, MBF/CO increased in all normal cases, whereas no changes or decrease was observed in all cases with definite ST depression. These changes were found to be significant ($p < 0.1$).

In conclusion, 201-Tl myocardial scintigraphy was valuable not only for IHD to identify the location and extent of perfusion defect, but also for HCM to identify the status of myocardial mass. Quantification of myocardial blood flow was especially useful on exercise loading, where an imbalance between oxygen supply and myocardial demand was suspected to exist such as in angina pectoris.

Elemental Analysis of Ascites Hepatomas by Proton Induced X-Ray Emission Spectroscopy

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Specimens were bombarded with protons accelerated by a Van de Graaff generator and this induced X-ray fluorecence. The X-ray have characteristics for each element, and indicate which elements are present in the specimens. Since Johansson et al. showed that proten-induced X-ray emission spectroscopy (PIXE) could be used to analyse many elements at the 10^{-12}g level simultaneously, a considerable number of reports have appeared in physics.

In this experiment PIXE method was used for elemental analysis of normal and malignant tissues. Specimens taken from liver, brain, serum and ascites hepatoma (AH-130) of rats, were bombarded with 3.5 MeV protons accelerated by the 5 MV Van de Graaff of Tohoku University, and induced X-rays were analysed with a Si (Li) detector. Absolute concentrations were determined with reference to a known concentration of uranium in the specimen. Small amounts of Ga, Yb and T1 which are known as the metals having tumors affinity were injected into rats implanted with AH-130 and its derivatives such as; AH-130 FG, AH-130 FGI, AH-130 FN, AH-130 FNI and AH-130 FNII. Twenty-four hours after injection, liver, brain, serum and hepatoma cells were removed from the rats and these specimens were analysed by PIXE method.

Concentrations of Fe, Cu, Zn and Br in liver, brain, serum and hepatoma specemins showed characteristic patterns respectively. The patterns of liver and hepatoma were quite similar, but the total amount of elements in liver was greater. AH-130 and its derivatives cell lines showed a different accumulation rate for Ga, Yb and Tl. The Ga concentration in free cell type (AH-130 FG and AH-130 FN) was more than that in island forming cell type. The concentration of Yb in liver was the greatest of three metals injected, and Ga in serum had the highest concentration. Tl was the only ininjected metals detected in brain.

Using a computed tomography 10^{-4} mole/g of Ga solution was distinguished from water by CT number. Total amount of Ga, Yb and Tl was less than 10^{-5} mole/g in each hepatoma cell line. These metals are not available for CT as a contrast medium at present.

There is a good possibility that we may be able to diagnose the grade of malignancy and the character of cancer by PIXE method to analyse the accumulation of several metals injected simultaneously, or by scanning using several radioisotopes and pulse height analyser.