4×10^6 counts/total area. Changes in uniformity with time, and the effects of varying window settings (photomultiplier tube gain adjustment, window width selection), counts rate, and geometrical variations (without or with scattering medium) were detected and evaluated by the parameters expressing the quantity of nonuniformity of a flood image and the differences in the uniformity of the two. The quantity of nonuniformity was defined as, $\sigma u = \sqrt{\sigma^2 - \bar{C}/\bar{C}} \times 100$ (%), where σ was the standard deviation of counts in region of interest and $\bar{C}$ was the average counts per matrix element. It was confirmed by some experiments that even if number of collected data for the flood image varied from 10 to 5×10^4 counts per element, this parameter has a constant value as compared with those of others. After smoothing the flood image by the Gaussian filter, the differences in the pattern of nonuniformity defined as the correlation coefficient(r) between the two flood images were calculated. Experimentally and theoretically, it was proved that the distortion of the pattern of nonuniformity could be ignored and the statistical fluctuation in flood image became small much the same as a flood image with counts more than 10^4 per element by using the optimal smoothing procedures. Changes in uniformity with time (for three months) and with counting rates (from 10^3 to 2.5×10^4cps) were insignificant. It was found that nonuniformity of parallel hole collimators was negligibly small compared to those of flood. The nonuniformity (σu) of the images which were measured over the window from 20 % to 80 %, at the settings in clinical studies and the correction co-efficient (r) between a flood image of 20 % window and the others were almost unchanged with window width, but varied significantly with and without scattering medium. But using the energy window less than 15 %, samll variation of the photomultiplier tube gain resulted in increasing of nonuniformity (σu) and the significant changes of the pattern (r) of nonuniformity. We concluded as follows: (1) field flood data should be acquired at the settings approximating the energy spectrum seen in clinical studies, (2) in the case of the window width less than 15 %, correction of the nonuniformity was difficult, (3) but with respect to the window more than 20 %, a flood images made with a certain window width and if the nonuniformity of collimator could be ignored, without a collimator was sufficient to correct the nonuniformity by a digital computer system.

Study of Myocardial Imaging and Cardiac Function of Patients with Old Myocardial Infarction

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A nucleo-medical study was made of the myocardial function and cardiac function of patients in whom a long time had passed after an attack of myocardial infarction and who were then living a normal life.

The patients were infused intravenously with 2 mCi of ^{201}Tl; the frontal and left oblique image were recorded with the scintillation camera 30 minutes later, and input simultaneously into the medical computer, together with the ECGs for the data analysis. Continuously, to the same patients, 20 mCi of ^{99m}Tc human serum albumin was infused as bolus and the cardiac blood pool was input into the medical computer, together with the ECG, to obtain the end-systolic and the end-diastolic image by gated scintigraphy to calculate the left ventricular ejection fraction.

The subjects consisted of 40 patients with old myocardial infarction, five with relatively fresh myocardial infarction, 20 with hypertension and 10 normal as control.

The sites of myocardial infarction all appeared as defects on the scintigraphy (of 34 out of 45 subjects), which were well consistent with their ECGs. The abnormalities on the scintigraphy varied in degree, but were larger in many patients than on the ECGs. Of the patients whose ECG abnormalities had considerably decreased, not a few presented considerable abnormalities on their scintigraphys.

It was found that the contractile movement of the infarcted site was weakened in many patients, and there were some patients who presented abnor-

mal contraction of the myocardium by the serial gated scintigraphy. This finding suggests the possibility that the scintigraphy will demonstrate degenerative changes in the myocardium such as fibrosis and disclose even slight decreases in the coronary blood flow. Some of the patients with hypertension, presented slight abnormalities in their scintigraphy of the myocardium.

The left ventricular ejection fraction was not less than 60 % in all control patients, while the rate was slightly reduced in many patients with hypertension, the data being distributed widely. The ejection fraction was markedly decreased in many patients with myocardial infarction, but remained within normal range in a rather few patients. This finding suggests the necessity of restricting the stress on the heart even of the patients who have been rehabilitated.

Factors in the Regulation of Regional Pulmonary Perfusion

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The purpose of the present study is to clarify factors which control the distribution of regional perfusion.

The right upper lobe (RUL) of an anesthetized dog was isolated in vivo by a balloon catheter under fiberoptic bronchoscopic guidance. The RUL was artificially ventilated by the following gases, while the rest of the right lung and the entire left lung were breathing air spontaneously; pure nitrogen (N_2), 10 % oxygen (O_2) in N_2, air, 40 % O_2 in N_2, 60 % O_2 in N_2, 100 % O_2 and 10 % CO_2 in air, each mixed with a trace amount of helium (He). Because preliminary studies indicated that, after 5th through 7th artificial gas exchange of the RUL, alveolar gas concentration of He, O_2 and CO_2 became nearly constant, either ^{99m}Tc-MAA or ^{99m}Tc-albumin microsphere was injected intravenously at the end of the 7th gas exchange. Radioactivity of the RUL, the remainder of the right lung and the right whole lung was measured with a scintillation camera at each injection of the tracer material.Radioactivity from the previous injection was subtracted as background, and perfusion distribution of each region was calculated. Alveolar gas was obtained from the RUL through the balloon catheter prior to the 1st gas exchange and at the end of the 5th, 6th and 7th exchange of each gas and was analyzed for He, O_2 and CO_2 concentration. The RUL was ventilated by either N_2 or air at various alveolar expansion monitored by alveolar pressure levels to learn the effect of alveolar expansion on regional perfusion distribution.

When the RUL was inflated to its maximal volume or to what we call the TLC of the RUL, perfusion distribution in the RUL was the least, while it was the greatest at the alveolar volume of tidal ventilation. Thus all studies were made at the alveolar expansion of tidal pressure range unless otherwise indicated. Regional perfusion decreased in the RUL when N_2, 10 % O_2 in N_2 or 10 % CO_2 in air was given as an inspired gas as compared with perfusion distribution when air was used as an exchange gas through the catheter. On the contrary, regional perfusion in the RUL increased when 40 % O_2 in N_2, 60 % O_2 in N_2 and 100 % O_2 were artificilly inhaled to that lobe as compared with when air was artificially given. The degree of perfusion increase was almost proportional to the degree of oxygen concentration in the exchanging gas. The amount of regional perfusion when 100 % O_2 was artificially given to the RUL through the catheter was almost equivalent to that when air was spontaneously inhaled into the same lobe without the catheter in place. Helium concentration in the alveolar gas was diluted when N_2 or 10 % O_2 in N_2 was used as an inspired gas, while it was concentrated in case of 40 % O_2 in N_2, 60 % O_2 in N_2 or 100 % O_2, indicating excretion of gas into the alveoli under hypoxia and absorption of the alveolar gas under hyperoxia. When the right lung-reimplanted dogs were studied in a similar fashion, regional perfusion in the denervated RUL