

grams after the irradiation of  $^{60}\text{Co}$ , considerable improvement was noticed on their scintigrams in some cases.

Concerning to their prognosis, our investigations should be required further more. Three of them are reported here.

## Applicability of Radioisotope Scanning of the Lungs

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Three aspects of applicability of radioisotope scanning of the lungs were presented.

1) Effect of Oxygen Concentration in Inspired Gas upon Pulmonary Arterial Blood Flow. This problem has been one of the most controversial problems of pulmonary physiology since the end of 19th century. Perfusion scanning of the lungs is best utilized for this purpose. Our present study has disclosed that the pulmonary arterial blood flow is regulated by oxygen concentration in the inspired gas, and if the oxygen concentration is less than that of air in one lung, while the other lung is breathing pure oxygen, the distribution of the pulmonary arterial blood flow in the hypoxic lung is reduced in a gross proportion to its oxygen concentration, although there is fairly wide range in the reduction ratio.

Fishman and others made the experiment of unilateral breathing of hypoxic gas of 10-12 percent oxygen concentration in six subjects and could not find any alteration in either total minute blood flow to each lung. They concluded at that time that the hypoxic stimulus did not affect directly upon either the lung or the post-arteriolar segments of the pulmonary vascular resistance to blood flow. Subsequently they tried the administration of 5 percent oxygen to one lung in five and found the reduction of the total flow perfusing the hypoxic lung in three. Defares and others studied the effect of 10 percent oxygen in thirteen normal subjects and concluded a significant change in flow ratio occurred in hypoxic lung. In our study inhalation of 12 and 15 percent oxygen revealed a significant reduction of the pulmonary arterial blood flow to the hypoxic lung. The Fick principle was used so far by most investiga-

tors, but we gave up both the catheterization and arterial cannulation and just tried to see the effect of unilateral hypoxia on the partition ratio of the pulmonary arterial blood flow to each lung by means of radioisotope perfusion scanning of the lungs.

2) Estimation of Pulmonary Arterial Blood Flow in the Transplanted Lung of the Dog. Forty perfusion scannings of the dogs which were home- or auto-transplanted unilateral lung were performed by injecting 50-70 microcuries of  $^{131}\text{I}$ -MAA intravenously. It is difficult to estimate the lung function of the dog whose unilateral lung was transplanted. But perfusion scanning can reveal how much blood flow is persistently present in the transplanted lung. The calculated blood flow from the cps curves obtained at the scanning procedure can grossly tell how much rise of the pulmonary arterial pressure is expected during contralateral pulmonary arterial obstruction. Perfusion scanning in lung-transplanted dogs is now an indispensable procedure to assess the function of the transplanted lung of the dogs.

3) Pulmonary Scanning after Infusing  $^{131}\text{I}$ -MAA through the Bronchial Artery. In ten patients of lung cancer,  $^{131}\text{I}$ -MAA was infused through the bronchial artery in order to obtain the positive image of tumor itself by means of pulmonary scanning. The particles of  $^{131}\text{I}$ -MAA are not only trapped in tumor vessels but also are they captured by intercostal arteries and other bronchial arterial branches. Therefore the image obtained by the scanning is widely spread and it is not possible to obtain only tumor image itself, but the area perfused by the bronchial artery. And there is no evidence that the clearance rate in the non-tumor area is quicker than

in the tumor area. Clearance rate of  $^{131}\text{I}$ -MAA is almost identical in various areas of the lung in a same subject. It was concluded from our study that the scanning of the lungs

after  $^{131}\text{I}$ -MAA infusion into the bronchial artery was not useful in clinical diagnosis and treatment of lung cancer.

## Regional Pulmonary Blood Flow in Tuberculous Patients

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This presentation was reported about the pulmonary scanning with  $^{131}\text{I}$ -MAA as a result of studies in 700 cases. All cases were pulmonary tuberculous patients.

The procedure of dot and photoscanning;  $^{131}\text{I}$ -MAA was injected intravenously.

All injections were made with the patients in the supine or lateral decubitus position. Scans were performed with the Nihon Musen scintillation scanner. The dot and photoscanning were made together in 5 minutes at the supine position after the completion of injection. Dose of 200  $\mu\text{Ci}$  of  $^{131}\text{I}$ -MAA were adequate. The procedure were required about 1 h. with scan speeds of 1.7 cm/sec. and pitch of 2 mm. The collimator was used F.15 cm of F.10 cm. One dot was made 8 counts per 0.1 sec.

The procedure of the blood flow rate to the right and left lung; Scan was run from right to left. The counting rate with time constant 0.3 sec. was proportional to the amount of  $^{131}\text{I}$ -MAA in the each lung slice.

The blood flow rates to the right and left lung were determined with counting rate. The 8 slices of counting rate were made in the lung of each patient.

The posture during the injection of  $^{131}\text{I}$ -MAA; Different posture were used during the injection of  $^{131}\text{I}$ -MAA. The first, position was usually used supine position. The second, in the cases of paradoxical blood flow with usual posture, especially diminished radioactivity on the side of the pathological X-Ray shadow of the lung, position was used lateral decubitus.

The patient was placed in the supine posi-

tion for scanning after injection of  $^{131}\text{I}$ -MAA.

Results; In the case of the pulmonary tuberculous patient, four points should be taken into consideration.

1) The pulmonary blood flow in the involved region was diminished, and the ratio of the blood flow and the  $\text{O}_2$  consumption with bronchspirometry on 50 cases were the same, but a paradoxical value was showed in some cases.

2) In the cases of bronchostenosis and bronchial ulcer were showed diminished blood flow to their side of the lung.

3) In some cases of the diminished blood flow in the involved region, the blood flow and the  $\text{O}_2$  consumption were increased with lateral decubitus position downwards the involved region during injection of  $^{131}\text{I}$ -MAA.

In the routine examination of pulmonary scanning, the lateral decubitus position is useful method for examination of circulatory dynamics in pulmonary tuberculous patients.

4) Comparing the blood flow of the right lung to the left lung in the patients, the diminished blood flow beyond the pathological X-Ray shadow of the lung was showed on the left side more than on the right. It is assumed that the anatomical discrepancy of the position on pulmonary artery and bronchus make a difference to effect on the pulmonary blood flow.

The left pulmonary artery runs through a ring of the bronchus, this ring is made of main bronchus, B.1, B.2, B.3, and B.6. The pathological change is easily effected to decreasing pulmonary blood flow.