

administered for fifteen minutes via a carlens catheter.

The partition of pulmonary arterial blood flow between the two lungs was determined by radioisotope scanning following intravenous injection of  $^{131}\text{I}$ -MAA both during bilateral air breathing and unilateral hypoxia.

The optical density of the radioscan is a nearly linear function of the amount of radioactivity at that locus. Therefore, the optical density of each lung field on the scan is proportional to the distribution of  $^{131}\text{I}$ -MAA between the two lungs. The average density of each lung field was measured using a fluorodensitometer devised by us.

Unilateral hypoxia produced a decrease in pulmonary blood-flow to the hypoxic lung. It seems that a decreased pulmonary blood flow

distribution results from pulmonary vasoconstriction.

We found one patient with bronchogenic carcinoma located at the left stembronchus in whom the scan indicated obstruction of pulmonary blood-flow to the left lung in spite of no abnormal finding on chest x-ray and pulmonary arteriogram. It was possible to make radical pneumonectomy in this case because of no vascular invasion and no metastasis of mediastinal lymph nodes.

It is probable that a decrease of pulmonary blood-flow distribution to the left lung in this case was caused by alveolo-vascular reflex. Therefore, the decreased density of the scan in bronchogenic carcinoma not indicate completely cancer invasion to the pulmonary artery.

### **Study on the Shift Ratio of Pulmonary Blood Flow in Right or Left Lateral Positions with Special Reference to the Radiation Effect on the Cases Having Pulmonary Carcinoma**

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$^{131}\text{I}$ -MAA pulmogram method has been used by us to estimate the relative amount of pulmonary blood flow to bilateral lungs.

In our former experiences on normal subjects, it was found that the mean right to left ratio in supine position was 53.3% to 46.7% by using this technique; and in lateral position another 10 or 20% flows excessively into the lowersided lung.

In cases with diffuse obstructive pulmonary disease, however, the shift ratio to the diseased lung in lateral position markedly decreased. This fact probably indicates that the combined use of  $^{131}\text{I}$ -MAA pulmogram and lateral position might be very useful to know the reserve of the pulmonary capillary beds.

This time we are to report the change in the shift ratio of pulmonary blood flow in connection with pre- and post-irradiation against pulmonary carcinoma.

Seventeen patients with pulmonary carcinoma were examined. Six out of 17 were

peripheral type and the others were hilar. In supine position, the disturbance of pulmonary blood supply to the diseased lung was much less in cases of peripheral type than in hilar type.

In lateral position, however, the change in the amount of shift to the diseased lung was quite variable and did not depend upon the localization of carcinoma. Even in the cases of hilar type, which showed decreased blood supply (less than 30%) to the diseased side in supine position, more than a half of them showed an increase of another 10% or more in lateral position.

Ten out of the above-mentioned 17 cases were studied on the pulmonary blood supply right after the radiation therapy was through. These were composed of 7 cases of hilar type and 3 cases of peripheral type.

As for the cases of hilar type, in general, the pulmonary blood flow to the diseased lung seemed to increase in supine position after the radiotherapy. However, the change in the

amount of shift to the diseased lung in lateral position was quite variable.

In peripheral type, pulmonary blood flow in supine position was found almost unchanged

after the radiotherapy in this series. The change in the amount of shift to the diseased lung was found increased in one case and unchanged in the remaining two.

## Studies on Regional Disturbance of Respiratory Function in Various Pulmonary Diseases

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The present report describes about the detection of regional impairment of ventilation and perfusion in various pulmonary diseases.

As one of this purpose, pulmonary scanning after intravenous administration of  $^{131}\text{I}$ -Macroaggregated Albumin has been used to study the regional distribution of pulmonary arterial blood flow in 159 cases with chronic pulmonary diseases. Chronic bronchitis with severe obstructive ventilatory disturbance, chronic pulmonary emphysema and severe pneumoconiosis cases show the lung scan revealing diminished radioactivity or diminished with absence of radioactivity in multiple areas. This information is suggested severe impairment of regional pulmonary arterial blood flow in these cases.

Inhalation scanning using  $^{198}\text{Au}$  Colloid was added to investigate the correlation between

regional disturbance of ventilation and perfusion. Chronic bronchitis shows a good correlation between regional diminished radioactivity of inhalation scan and perfusion scan. Some cases of chronic pulmonary emphysema also reveal same good correlation, but another cases show more decreased radioactivity in inhalation scan than perfusion scan.

In addition, radioactive gas ( $^{133}\text{Xe}$ ) was used to obtain information of dynamic change of regional impairment on ventilation and perfusion. The radioactive Xenon was administered either by inhalation or intravenous injection. Half time for Xenon clearance and 90% wash-out time were determined from the  $^{133}\text{Xe}$  clearance curves following inhalation or intravenous injection. Extension of 90% wash-out time and half time for Xenon clearance were found in chronic bronchitis with obstructive ventilatory disturbance.

## Relationship between Lung Scan and Operability of Lung Cancer

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A comparative appraisal was carried out on chest x-ray films and lung scans of 29 cases with primary lung cancer which were

taken ten days or less before pneumonectomy. Lung scanning were performed by isosensitive dual-probe scanner. A definite relation-