Study on Scintigrams of Lung

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The present communication deals with the results obtained of the lung-scintiscanning with ^{131}I-macroaggregated albumin (^{131}I-MAA) conducted on 29 cases of lung diseases composed mainly of lung tuberculosis. The subjects were 23 cases of lung tuberculosis, 4 of lung cancer, one of silicosis, and one of pancreatic cancer with hepatic metastasis. Examinations were commenced five minutes after venous injection of 200 μCi of ^{131}I-MMA at supine posture. The apparatus used was Toshiba ML ^{201}II model scintiscanner (2 $\times$ 2″ NaI crystal, 12 mm straight collimeter), which was modified as to enable us to take one color scintigram and two spark scintigrams with distinct radioactivity levels.

The incidence of injury detected in the scintigrams of various fields is greatest (55%) in the right lung apex and left sinus phrenicocostalis, followed by the right upper lung field (52%) and the left lower lung field (41.5%). The roentgenograms of the lung injury as detected in the scintigram revealed a high rate of swelling, infiltration, elevated diaphragm, and shrinkage of the thoracic cavity. In addition, the detectable rate of lung injury by the scintigrams was 100% in atelectasis, elevated diaphragm, and shrunken thoracic cavity, and it was about 50 to 80% in other pathological findings.

In the scintigrams taken from 7 cases who underwent lung lobectomy or the reconstruction of thoracic cavity, there can be observed a considerable circulatory damage in the residual lobes in those less than 2 and half years after either operation, but a distinct recovery can be seen in those 5 years after the operation. The scintigrams of those receiving lobectomy generally tend to reveal a heavier damage to the circulatory system as compared with their X-ray pictures. In contrast, in three cases who had complication of a marked swelling after pleuritis, strangely the circulatroy damage is slight as compared with their X-ray pictures. In the four cases of lung cancer the scintigrams reveal the injury in the atelectatic field but there was a case who showed circulatory damage of the lung field adjacent to the atelectatic field revealed no striking injury in X-ray pictures. Although this case died shortly afterwards, it is presumed that foci had developed extensively prior to the injury being detected by X-ray pictures. Therefore, it is concluded that this scintiscanning method will afford clearly a significant approach to know the prognosis in lung diseases.

Studies on Distribution of Regional Pulmonary Blood Flow by Scintillation Scanning (I)

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By means of the lung scintiscanning, it has become possible to know quantitatively the ratio of the regional pulmonary blood flow and to understand better the relationship of pulmonary function to regional pulmonary vascular beds.

Before performing scintiscanning of the lung on human subjects, mice treated with inorganic iodine before hand were given 10–20 μc of ^{131}I-MAA i.v. and sacrificed at each predetermined time. Radioactivity of the lungs, liver, spleen, kidneys, brain, heart, thyroid and the G.I. canal was measured by the well-type scintillation counter. Ninety-two to ninety-three per cent of the injected dose remained in the lungs in the first forty-five minutes, and then decreased slowly until 120 minutes when eighty-five per cent of the

injected dose remained in the lungs. Half-time of radioactivity in the lungs was 300 minutes. Radioactivity in the liver was maximally ten per cent at 300 minutes after injection. Radioactivity in other organs was negligibly small. This tendency can be ascertained by autoradiography using ^{125}I MAA. Studies of concentration in blood and excretion in urine showed that the blood level was always below two per cent of the injected dose and that fifty per cent of the injected dose was excreted in the first twenty four hours in urine and ninety five per cent in forty eight hours.

104 human subjects injected 100–150 μc of ^{131}I-MAA i.v., have been scanned without any side effect since May '65 using Shimadzu SCC-30 with 36 holes focussing collimator. Photorecorder SCC-Y3, dot recorder and rate meter were driven simultaneously.

The ratio of the pulmonary bolod flow obtained by analysis of cps curves of the rate-meter corresponded well to the ratio of oxygen consumption measured by differential broncho-spirometry in nine patients of various chest diseases. The maximum difference between the two procedures was ten per cent in one subject. In ten normal subjects, the ratio of the pulmonary blood flow in the right and the left lungs were 55:45 and 56:44 in the sitting and supine positions respectively. The ratios of the upper half of the lung and its lower counterpart were right 0.95: left 1.07 and right 1.60: left 1.88 in the sitting and supine positions respectively. In a case of dextrocardia the ratios were completely reverse in the right and the left lung.

A diagram of ratios of pulmonary blood flow in the right and left lungs and their scintigrams were shown in ten different chest diseases. Ratios of the pulmonary blood flow in bronchial asthma, emphysema, sinobronchitis, sarcoidosis and acquired heart diseases were within the range of normal value, but in some cases of lung cancer and bronchiectasis the ratios were extremely deviated from the normal range for the extent of the lesions. In tuberculosis, abscess, atelectasis, pneumonia and cysts, the ill side of the lung showed decreased pulmonary blood flow.

Clinical Significance of Lung Scanning with ^{131}I-MAA

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Scintiscanning of the lungs using ^{131}I-macroaggregated albumin (^{131}I-MAA) offers a new approach to the diagnosis of pulmonary infarcts. Since pulmonary blood flow to various regions of the lungs can be detected by the lung scan, this method is useful for diagnosis of chest diseases which are apt to obstruct regional pulmonal artery. Up to now, lung scans were performed on about 100 cases. In our opinion, the lung scan can give us some information about the difference between primary pulmonary cancer and secondary one. Of 16 cases of primary pulmonary cancer studied, 11 cases showed larger scintigraphical defect than radiographical abnormal area. This is probably due to a pressure to the pulmonary artery trunk from the metastatic hilar adenopathy. Accordingly, when it demonstrates larger scintigraphical defect than radiographical abnormal area, there is no indication of a surgical operation. In 5 of 16 cases the scintigraphical defect was almost the same size of radiographical abnormal area. In these cases metastatic hilar adenopathy could not be demonstrated at operation time. Only one showed smaller scintigraphical defect than radiographical abnormal area. On the contrary, 7 of 9 cases of secondary pulmonary cancer showed smaller scintigraphical defect than radiographical abnormal area, and no cases larger scintigraphical defect than radiographical abnormal area. This may be possibly to be a help for the differential diagnosis between primary pulmonary cancer and secondary one.

By comparing radiographical findings with scintigraphical findings, pulmonary diseases can be diagnosed more precisely. Since this method can detect pulmonary blood flow