

Combination Scanning Procedures in the Evaluation of Bronchogenic Carcinoma

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Recently we reported the localization of radioactive ¹⁹⁷mercury in extra-cranial neoplastic and non-neoplastic pathology (1,2). The ¹⁹⁷mercury scanning technique for neoplastic localization has proven most useful in the planning of therapy for primary lung carcinoma. The ¹³¹I macroaggregated albumin lung scan has also proven useful in the study of patients with bronchogenic carcinoma (3).

We shall present instances where the ¹⁹⁷mercury technique, in combination with the ¹³¹I MAA lung scan has proven useful in evaluating patients with bronchogenic carcinoma.

METHODOLOGY

Fifty-two patients were referred to this department for further evaluation of lung pathology. These patients were scanned 24 hours following the intravenous administration of one millicurie of ¹⁹⁷mercury chlormerodrin. The ¹³¹I MAA lung scans were performed immediately following the injection of 200 microcuries of ¹³¹I MAA. Each procedure requires approximately thirty minutes.

Our instrumentation included two 5 × 2-inch sodium iodide crystal photoscanners with color printer and one 3 × 2-inch sodium iodide crystal photoscanner.

On selected illustrative cases, surgical specimens were scanned and macroautoradiography and microautoradiography performed (Case illustrations 1 and 2).

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DISCUSSION

The case histories were done in conjunction with the diagnostic work-up of primary bronchogenic carcinoma and were of aid in the diagnosis and treatment pattern of the patients.

The first patient had a pneumonectomy and the second expired the day following surgical biopsy. In the recovered pathology specimens, it was found that the *in vivo* scan picture of the localization of $^{197}\text{mercury}$ was an exact duplicate of the *in vitro* scan. Microautoradiography was done on both specimens and it was noted that the $^{197}\text{mercury}$ localization in the carcinomas was sporadic and not uniform. This finding would explain negative results reported in small tumor masses. The nature of the $^{197}\text{mercury}$ localization in neoplastic disease is still unknown.

In case number three, a classic positive Papanicolaou sputum smear was found early in the patient's evaluation. The ^{131}I MAA lung scan revealed impairment of the left pulmonary artery segment. The combination of a positive Papanicolaou and demonstration of an attenuation of the left pulmonary artery has been reported as a basis for nonresectability (4). For this purpose, the ^{131}I MAA lung scan may replace the angiographic technique in establishing impairment of the left pulmonary artery segment. This case demonstrates not only the applicability of the $^{197}\text{mercury}$ scan, but also the desirability of utilizing the ^{131}I MAA lung scan, $^{197}\text{mercury}$ brain scan and $^{85}\text{strontium}$ bone scan.

In regards to the ^{131}I MAA lung scan in pulmonary carcinoma, we have noted that in the majority of instances, the basal branches of the pulmonary

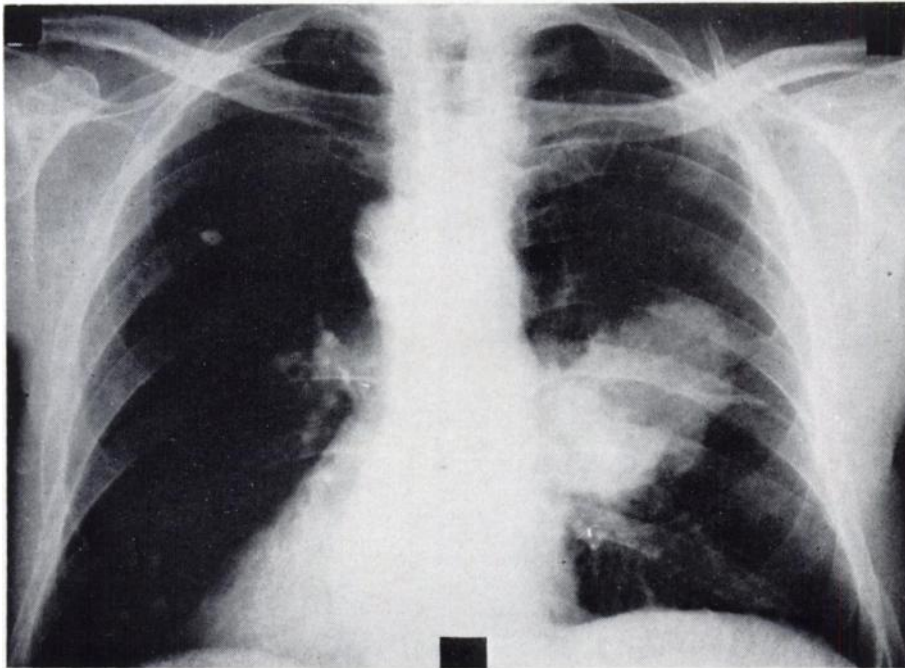
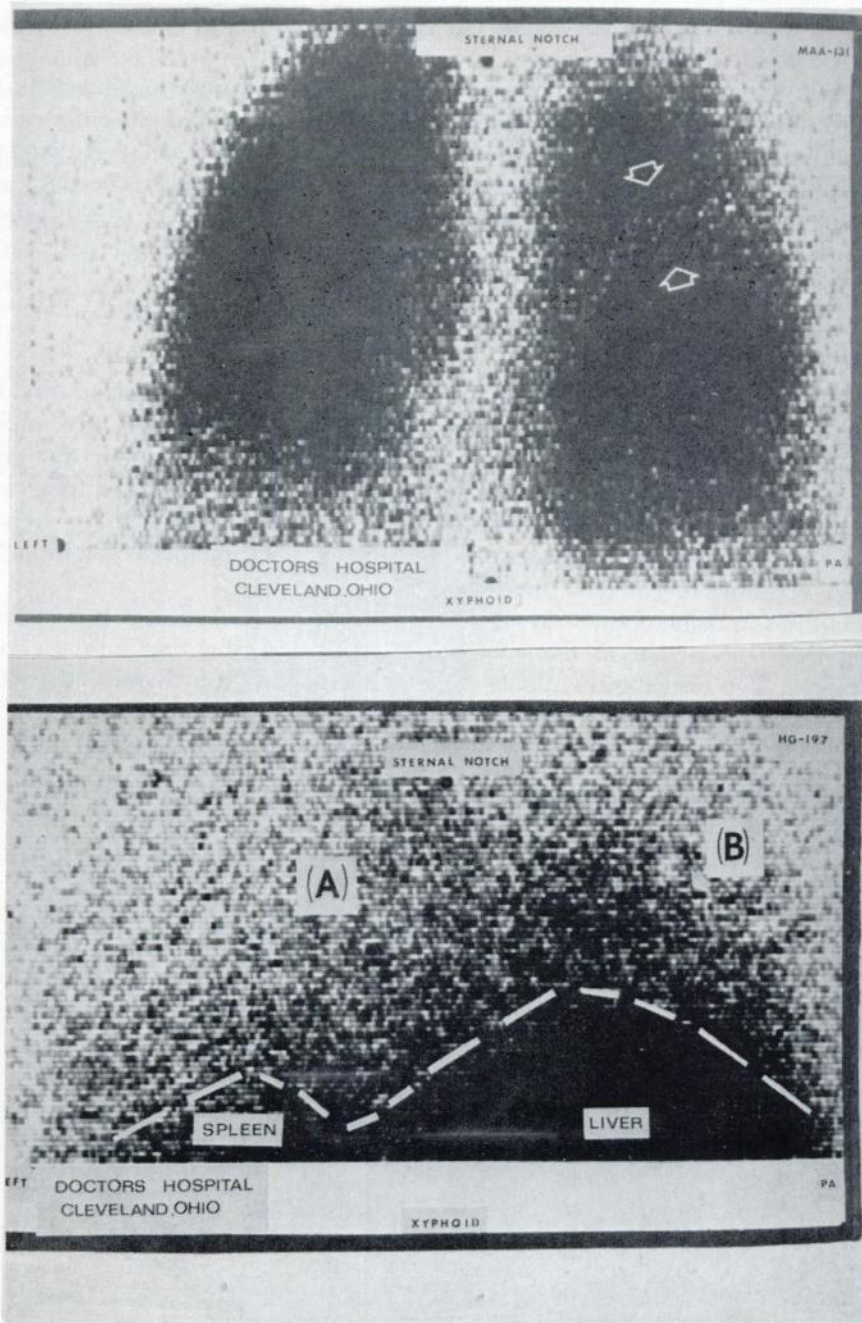


Fig. 1.



Figs. 2 and 3.

artery can be obliterated or blood flow attenuated in the early growth phase of bronchogenic carcinoma.

In the total patient series of fifty-two patients, thirty-two were interpreted as normal and twenty as abnormal. Of the twenty abnormal patients, fourteen correlated with tissue diagnosis.

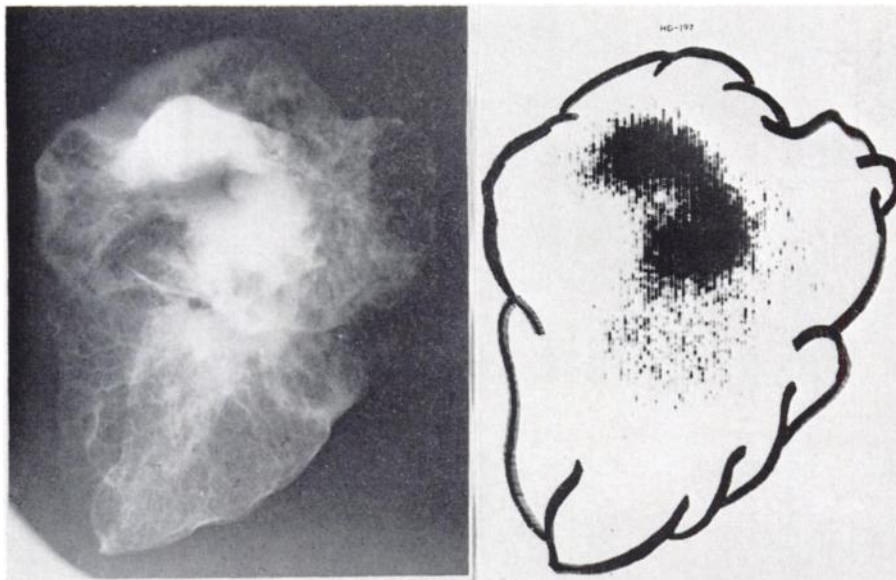
As we have reported, $^{197}\text{mercury}$ chlormerodrin will also localize in areas of active inflammatory disease. Therefore, the $^{197}\text{mercury}$ chlormerodrin localization in the lung should be interpreted with caution and a cellular diagnosis sought on each patient. The correct utilization of this scanning procedure and the other mentioned procedures will further aid the physician in the diagnosis and therapy of patients with this frequently encountered diagnostic enigma of lung carcinoma.

Case Report No. 1

A sixty-six-year-old white male with a history of producing blood streaked sputum for one month. The patient was otherwise nonsymptomatic. He smoked one pack of cigarettes a day, but stopped smoking at approximately age sixty.

Physical examination was entirely normal. Routine laboratory studies were also normal. First strength PPD was negative. Initial sputum cytology reports were negative and three were reported as showing questionable cells. Bronchial cytology washings revealed no tumor cells.

On the admission chest x-ray, there was a tumor described as $8 \times 8 \times 4$ cm. arising from the region of the anterior mediastinum extending into the right hemithorax. The radiologist's report suggested tumor of the thymus. Bronchoscopy was performed without incident and was normal.



Figs. 4 and 5.

The mercury-197 scan revealed mercury concentration in the entire superior portion of the right lung field and the mediastinum. We noted that the right lower lung field could not be visualized on the mercury scan as the liver accumulates mercury. The MAA I 131 scan shows a gross defect involving the majority of the lower segment of the right upper lobe.

At surgery a mass was found involving the right hilar region and a right pneumonectomy was performed. The specimen was scanned in the Nuclear Medicine Department and the scan image corresponded exactly with the soft tissue x-ray of the specimen with mercury concentrated in the excised lesion.

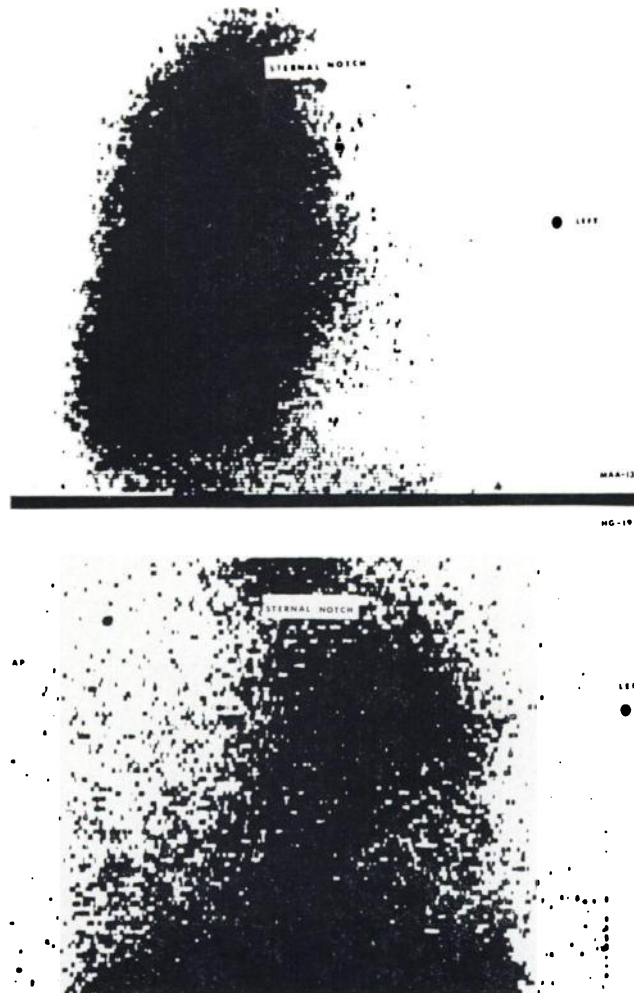


Fig. 6.

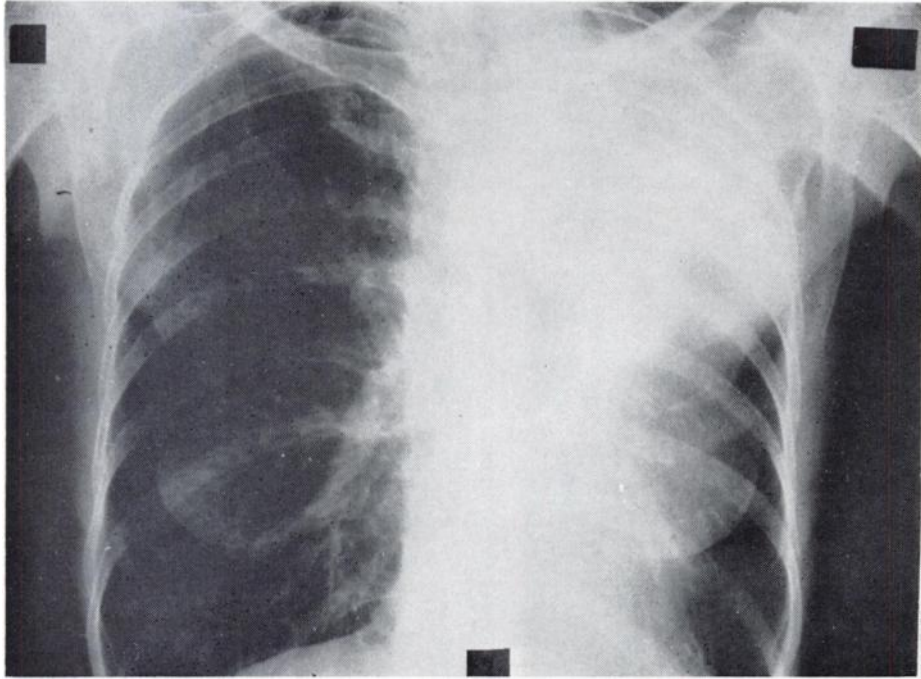
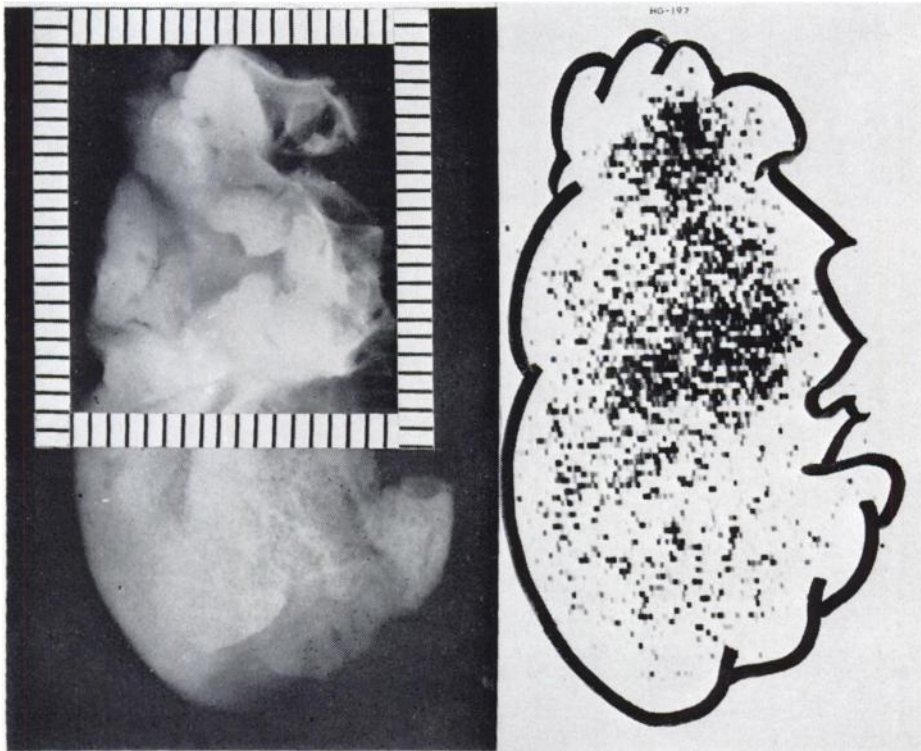
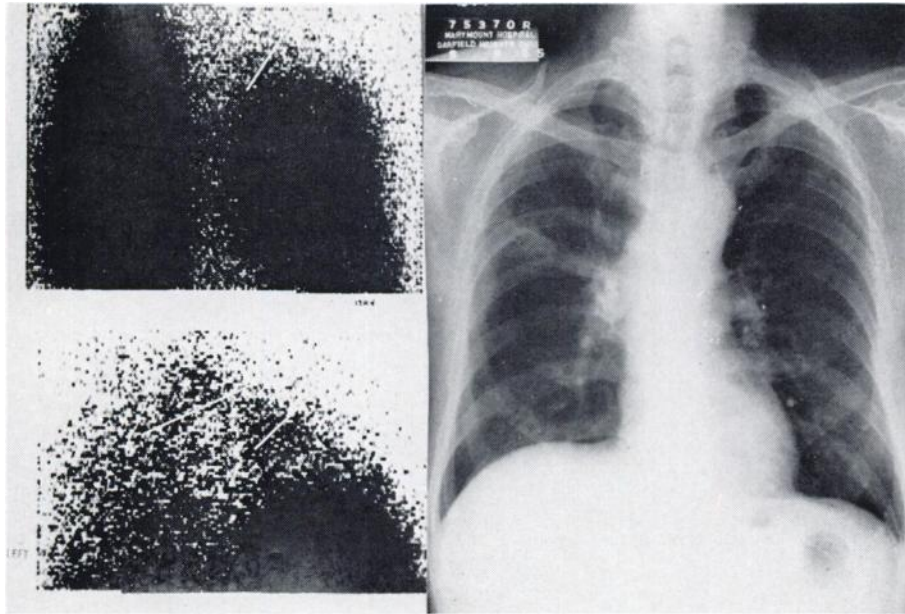


Fig. 7.



Figs. 8 and 9.



Figs. 10 and 11.

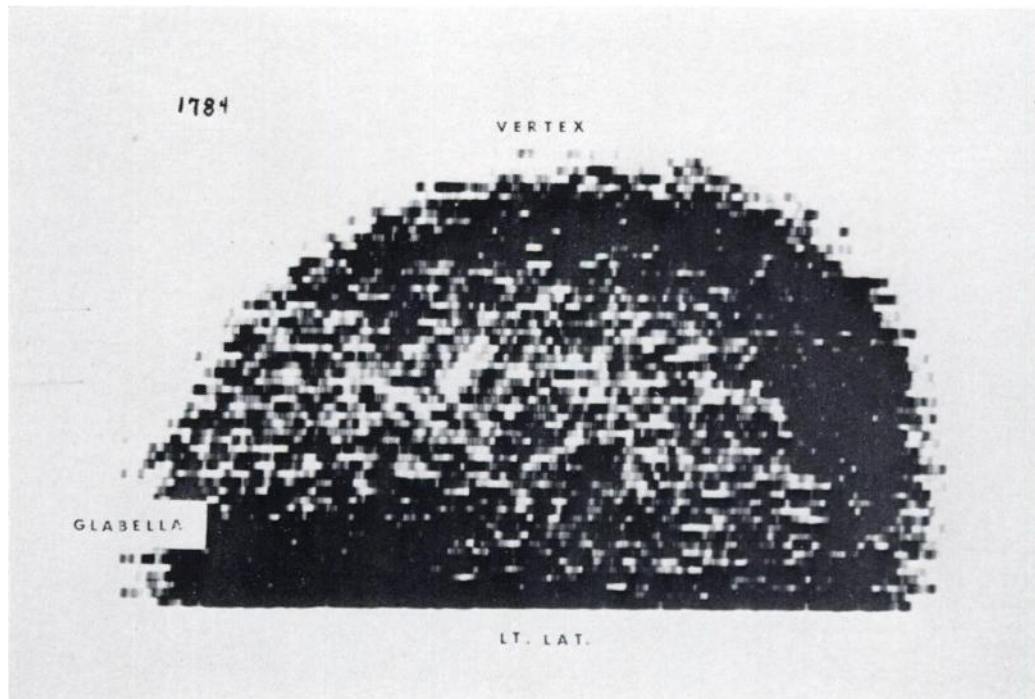
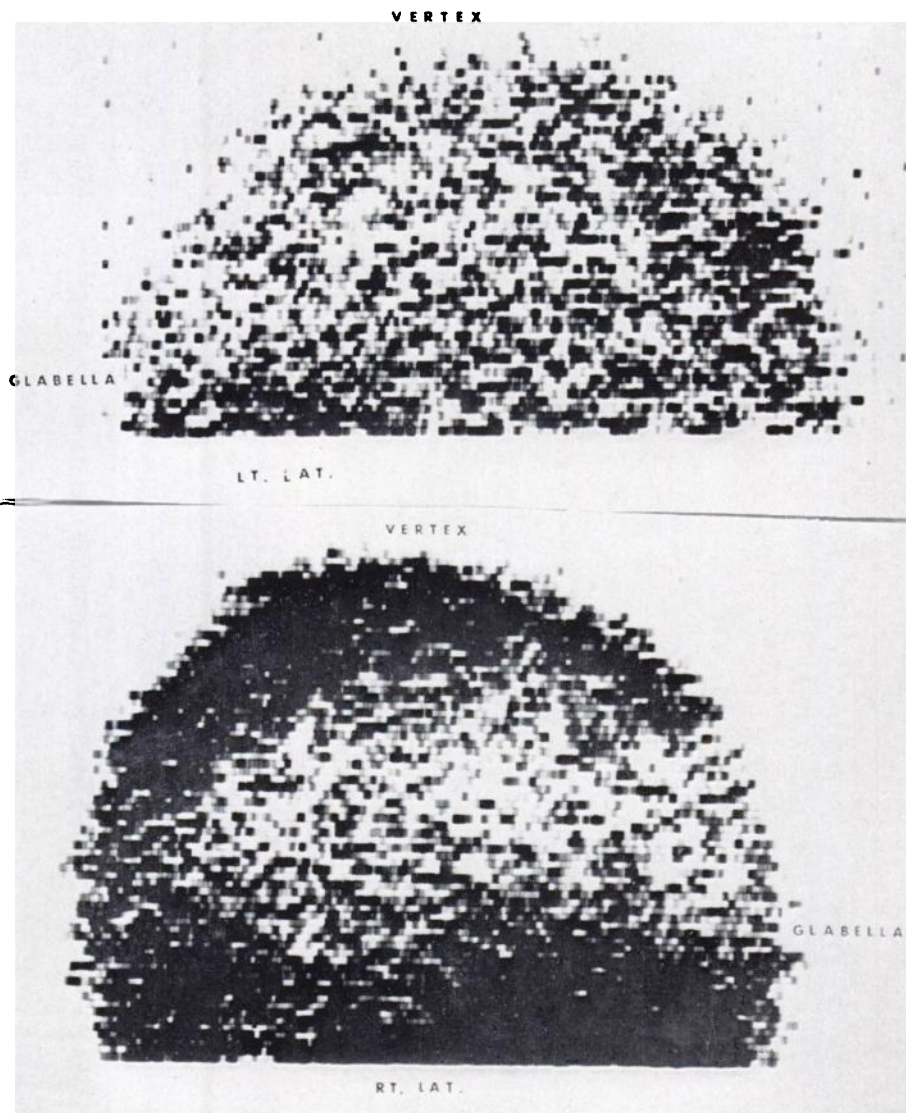


Fig. 12.

Case Report No. 2

A fifty-year-old white female was presented with left precordial chest pain which had been intermittent for one year. The patient had noticed progressive shortness of breath on exertion and fatigability.

Laboratory results revealed a normal hemogram and repeated sputum cultures for acid-fast bacilli were negative. Multiple sputum tests were reported as revealing questionable cells. Chest x-ray revealed a mass extending from the left hilar region with complete atelectasis of the left upper lobe.

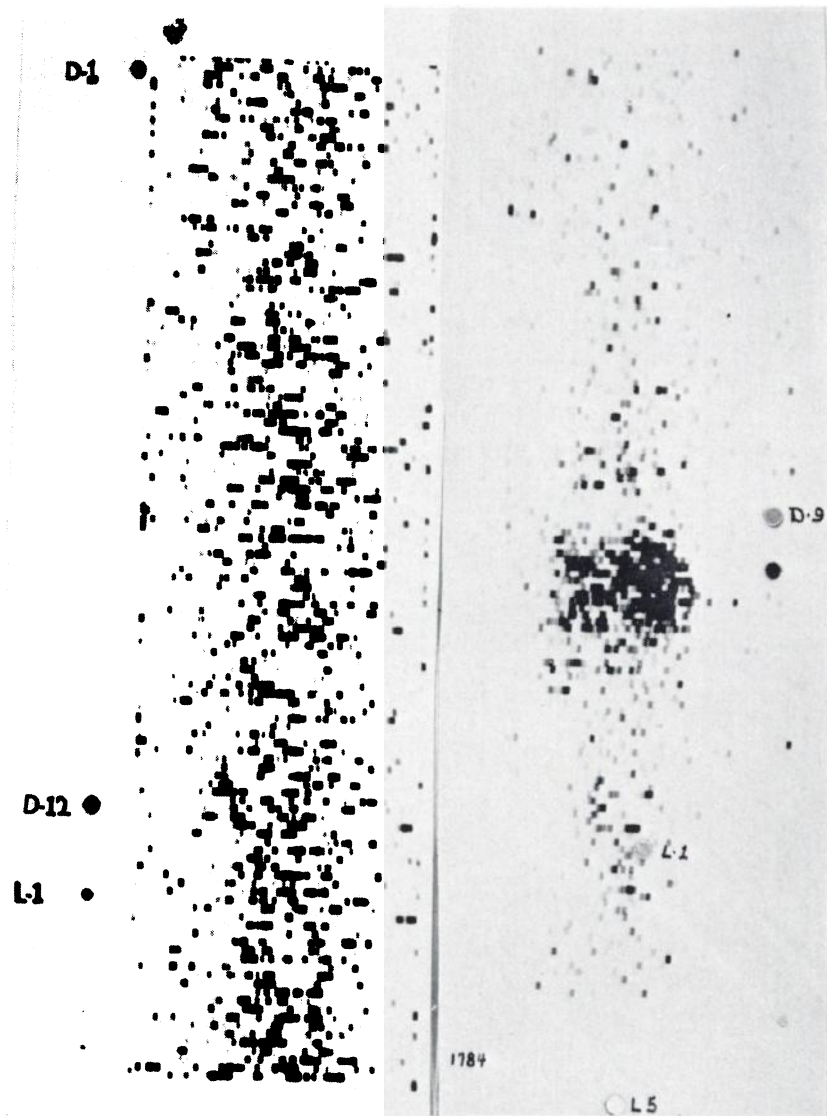


Figs. 13 and 14.

Bronchoscopy revealed deviation of the left main stem bronchus outward, laterally and upward. No tumor was seen; however, the left upper lobe orifice could not be visualized.

The 24-hour mercury scan was abnormal with retention of mercury throughout the region of the left upper lobe and the mediastinum. The MAA iodine-131 pulmonary scan revealed absence of the pulmonary segment on the left.

At surgery, a large inoperable tumor was found involving the entire left hilar area and invading the mediastinum. Biopsy report revealed anaplastic small cell and medium cell bronchogenic carcinoma.



Figs. 15 and 16.

The patient had a stormy post-operative course and expired the day following surgery. At autopsy, the remaining tumor in the lung was described as extensively invading the bronchial and peribronchial walls and lymph nodes. The removed left upper lobe was taken to the Nuclear Medicine Department and scanned and a soft tissue x-ray was made of the same specimen. It will be noted that the scanning image exactly duplicates the area of tumor visualized on x-ray.

Case Report No. 3

A sixty-year-old white male was admitted because of weight loss, continued weakness and dyspnea, cough and chest pain. All x-rays, including a skeletal survey, were normal. The only positive finding was bronchial washings which revealed tumor cells.

The 24-hour mercury retention scan demonstrated mercury accumulation in the entire area of the left upper lobe and mediastinum. Other scans were performed at this time. The MAA iodine-131 scan revealed an entire absence of concentration of MAA in the area of the left superior branch of the left pulmonary artery. A brain scan revealed areas of mercury accumulation in brain tissue compatible with diffuse metastatic disease. The strontium bone scan was done because this patient had percussion tenderness over D 10. The scan revealed strontium retention in the D 10 area. At autopsy, all primary and metastatic sites were proven.

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