Gallium-67 Uptake by a Malignant Fibrous Histiocytoma: Case Report

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Avid ^{67}Ga-citrate uptake was observed in a malignant fibrous histiocytoma of the mediastinum. The relationship of the tumor to the heart and liver was shown by ^{99m}Tc-sulfur colloid liver–spleen scanning and ^{99m}Tc-pertechnetate angiography performed in conjunction with a ^{67}Ga-citrate whole-body scan. This is the first report of ^{67}Ga-citrate uptake by this unusual tumor.

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Malignant fibrous histiocytoma is a very uncommon tumor which has only recently been defined as a pathologic entity (*1*). It typically presents in late-middle-aged males as an asymptomatic subcutaneous mass in an extremity (*2*). Local recurrence after excision is common, but metastatic spread to the lung and regional lymph nodes is less common, and widespread metastases are rare (*2*).

Gallium-67-citrate, which localizes in a wide variety of tumors (*3,4*), has particular affinity for tumors of the reticuloendothelial system. Scanning with ^{67}Ga-citrate has been found valuable in the staging of lymphomas, including histiocytic lymphoma (*5,6*). This report appears to be the first description of a positive ^{67}Ga scan in a patient with a malignant fibrous histiocytoma.

CASE REPORT

A 41-year-old white man was admitted on January 28, 1975, complaining of dyspnea, increasing abdominal girth, and swelling of both legs. Six months before, he had undergone left pneumonectomy with partial pericardiectomy and partial left atrial resection for a tumor initially described as a leiomyosarcoma. Not all of the tumor, however, could be removed. Nine years before admission, a lesion described as a malignant melanoma had been excised from his upper lip.

Physical examination revealed jugulovenous distention and ascites. A loud S3 gallop was heard. The clinical impression was congestive heart failure, probably secondary to invasion of the heart by recurrent tumor. A chest x-ray, however, was only suggestive of a mass, and thoracentesis and paracentesis were negative for malignant cells by cytology. A ^{99m}Tc-sulfur colloid liver–spleen scan showed a focal defect in the spleen, which was interpreted as either an infarct or a tumor focus. A ^{67}Ga-citrate scan (70 μCi/kg) showed a large area of markedly increased uptake, with a cold central area within it, in the lower mediastinum (Fig. 1).

To evaluate the possible involvement of the upper liver, the scintillation camera was set at 140 keV with a 25% window, and 3 mCi of ^{99m}Tc-sulfur colloid was injected intravenously. The mass was seen to rest in the region of the cardiac impression on the upper liver border; it did not involve the hepatic parenchyma. A 15-mCi dose of ^{99m}Tc-pertechnetate was then injected intravenously and 1-min scintigrams were taken (Fig. 2A). The cardiac blood pool was distorted and displaced superiorly by the tumor mass. Without moving the patient, the camera settings were adjusted for imaging with ^{67}Ga (centered at 184 keV, 25% window). After collecting approximately 150,000 counts at these energy settings, the technetium settings were restored and 150,000 counts were obtained in a superimposed projection (Fig. 2B).

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FIG. 1. Posterior view of ^{67}Ga-citrate whole-body scan shows avid uptake in perimeter of large midline mass.

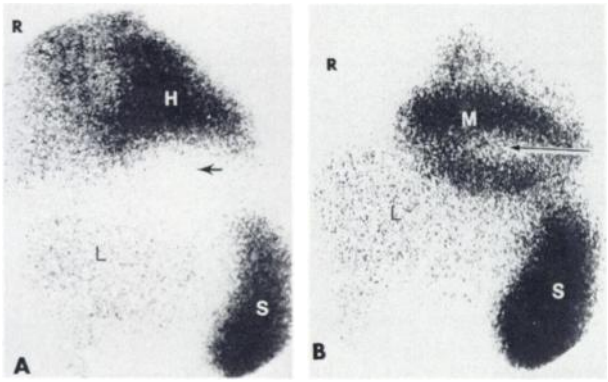

FIG. 2. (A) Composite picture of ^{99m}Tc-sulfur colloid study of liver (L) and spleen (S) and ^{99m}Tc-pertechnetate angiogram, anterior view, shows cardiac blood pool (H) to be displaced superiorly by avascular mass (arrow). (B) Composite picture, anterior view, shows ^{67}Ga uptake by mass (M) with central area of necrosis (arrow). Liver (L) and spleen (S) are uninvolved.

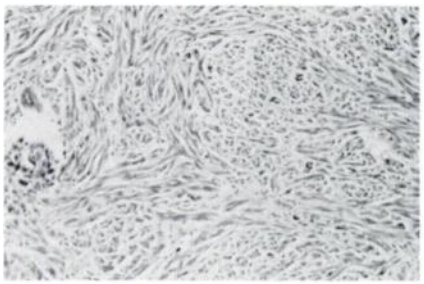

FIG. 3. Photomicrograph of histologic section of tumor removed from lung in July 1974 shows storiform (i.e., whirl-like) growth pattern. Hematoxylin–eosin stain; × 100.

The patient, after conferring with his family, elected not to undergo chemotherapy, and he died on February 19, 1975. At autopsy a large yellow-white tumor surrounded the left posterior, inferior, and right sides of the heart, which was displaced anteriorly and to the right. The tumor showed considerable central necrosis. The ^{67}Ga scan and the ^{99m}Tc cardiac blood-pool study closely correlated with the anatomic relationships between the tumor and the heart. Microscopic sections revealed tumor infiltration into the right ventricular myocardium. An infarct, but no tumor focus, was found in the spleen.

The histologic appearance of the tumor was similar to that of the neoplasm that had been partially resected 6 months previously (Fig. 3). The tumor consisted of interlacing bundles of elongated cells that frequently exhibited a storiform growth pattern, alternating with masses of histiocytic cells containing ovoid or reniform nuclei. These latter cells usually contained one or two eosinophilic nucleoli. Areas of transition between the two cell types were noted. Mitotic figures were numerous. Several microscopic foci were noted in which the tumor cells contained intracytoplasmic golden-brown pigment. Examination of these areas with the electron microscope revealed these granules to be lysosomes within the tumor cells. Neither premelanosomes nor melanosomes could be seen. At the ultrastructural level the fibroblastic and histiocytic nature of the two cell types was confirmed.

DISCUSSION

The occurrence of a storiform growth pattern in a tumor composed of a mixture of spindle and histiocytic-appearing cells is supposedly diagnostic of malignant fibrous histiocytoma. Ultrastructural studies have shown the presence of fibroblastic and histiocytic elements in these tumors (*7,8*), and tissue culture studies have pointed to a histiocytic origin (*7*). These tumors may arise as primary neoplasms within the retroperitoneum and from the soft tissues throughout the body. Their incidence of metastases is high (*1*).

The mechanism of ^{67}Ga uptake by tumors is uncertain. Gallium-67-citrate appears to be taken up into "lysosomal-like" granules. These subcellular particles contain a high concentration of acid phosphatase, and ^{67}Ga appears to be bound in some kind of macromolecular complex within these structures (*9*). Since histiocytes have abundant lysosomes, this may explain why tumors containing a high proportion of histiocytes tend to have avid uptake of the ^{67}Ga-citrate. For example, in a large interinstitutional cooperative study, histiocytic lymphoma was found to have the highest incidence of positive ^{67}Ga scans (55 out of 58 sites) of all histologic categories of lymphoma (*6*). The malignant fibrous histiocytoma is thought to be composed of histiocytes that differentiate into fibroblasts. The abundant lysosomal content and avid uptake of ^{67}Ga-citrate observed in this tumor are consistent with the hypothesis that the in

vivo subcellular concentration of ^{67}Ga involves structures resembling lysosomes.

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