

EXTRAOSSEOUS TUMOR UPTAKE OF  $^{85}\text{Sr}$  AND  $^{67}\text{Ga}$

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**Uptake of  $^{85}\text{Sr}$  in extraosseous malignant tumors without calcification was observed in two cases. The mechanism is unknown. Gallium-67 and  $^{87\text{m}}\text{Sr}$  have been used for detection of the tumor. Similar tumor uptakes of  $^{85}\text{Sr}$  and  $^{67}\text{Ga}$  were seen in one patient but tumor uptake of  $^{85}\text{Sr}$  and not  $^{67}\text{Ga}$  was observed in the other. This finding suggests that a different mechanism may be involved in the extraosseous malignant tumor uptakes of  $^{85}\text{Sr}$  and  $^{67}\text{Ga}$ .**

The value of radiostrontium in detecting bone metastasis has been well documented (1). Radiogallium has been used in the detection of extraosseous malignant tumors. However, uptake of radiostrontium by extraosseous malignant tumors without evidence of calcification has also been reported (2-6). These studies were done with  $^{87\text{m}}\text{Sr}$  scanned within a few hours after injection of the isotope. The following report presents two cases of such tumor with  $^{85}\text{Sr}$  uptake scanned 3 days after injection. The malignant tumor was shown as an increased uptake of  $^{67}\text{Ga}$  in one case but as a focal defect in the second case.

CASE REPORT

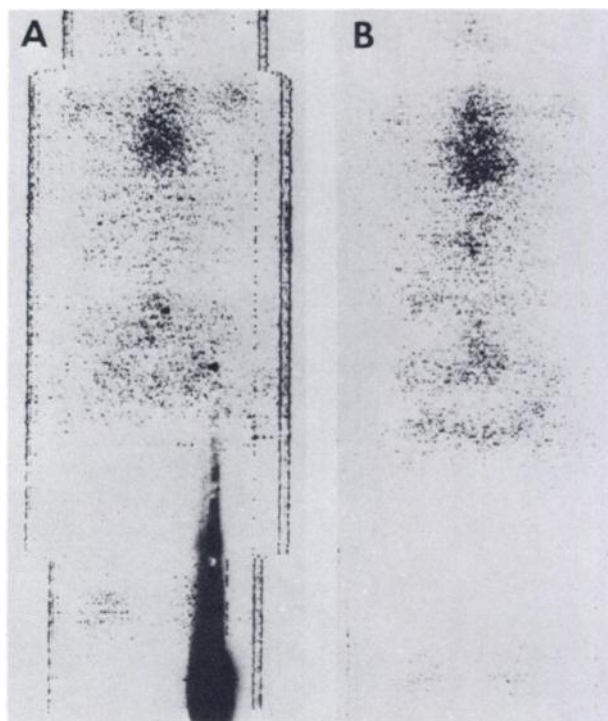
**Case 1.** A 55-year-old man was admitted with a growing mass in the right cervical region for 1 month. Hoarseness and productive cough were also present. Chest x-ray showed a large mass in the right superior mediastinum. Biopsy of the cervical mass disclosed anaplastic carcinoma. Strontium-85 total-body scan done 3 days after injection of 100  $\mu\text{Ci}$  of  $^{85}\text{Sr}$ -nitrate showed abnormal uptake in the upper mediastinum (Fig. 1A). Gallium-67 total-body scan done 2 days after injection of 2 mCi of  $^{67}\text{Ga}$ -citrate showed a similar finding (Fig. 1B). He was treated with radiation and cytoxan but died 3 months later. Autopsy showed right bronchogenic anaplastic carcinoma with extensive necrosis but without calcification.

**Case 2.** A 56-year-old man was admitted with history of colon adenocarcinoma diagnosed 2 years earlier. Metastasis to the dome region of the liver

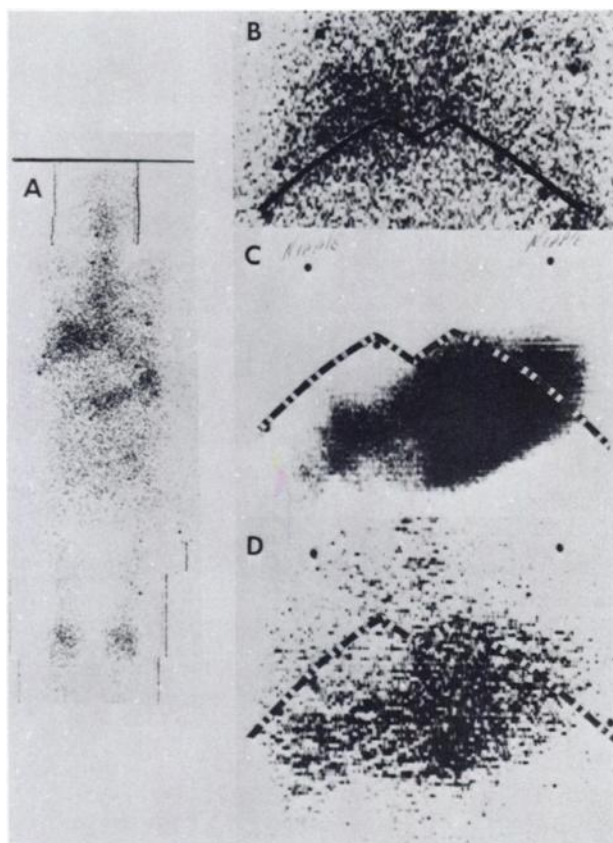
was found at laparotomy. Needle biopsy showed necrotic tissue admixed with well-differentiated adenocarcinoma. No calcification was identified histologically. He was treated with hepatic arterial infusion of 5 FU. Physical examination on this admission showed marked hepatomegaly and ascites. X-ray study failed to show calcification in the liver. Liver function tests were abnormal with markedly increased alkaline phosphatase. Strontium-85 and  $^{67}\text{Ga}$  scans were done with the same doses, chemical forms, and times of scanning as in the previous case. The  $^{85}\text{Sr}$  scans (Fig. 2A and B) showed an area of increased uptake corresponding to the focal defect shown on  $^{99\text{m}}\text{Tc}$ -sulfur colloid (Fig. 2C) and  $^{67}\text{Ga}$  scans (Fig. 2D).

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**FIG. 1.** Case 1. Bronchogenic carcinoma. (A and B) Anterior total-body scans with  $^{85}\text{Sr}$  and  $^{67}\text{Ga}$ , respectively. Note similar tumor uptakes of  $^{85}\text{Sr}$  and  $^{67}\text{Ga}$  in upper mediastinum.



**FIG. 2.** Case 2. Metastatic adenocarcinoma in dome region of liver. (A) Anterior total-body  $^{85}\text{Sr}$  scan. Note uptake in liver tumor. (B) Enlarged view of abnormal  $^{85}\text{Sr}$  uptake in liver. (C and D)  $^{99\text{m}}\text{Tc}$ -sulfur colloid and  $^{67}\text{Ga}$  liver scans, respectively, showing similar focal defects. Note:  $^{85}\text{Sr}$  uptake corresponds to focal defect on  $^{67}\text{Ga}$  scan.

#### DISCUSSION

Strontium uptakes were detected in the extraosseous malignant tumors without evidence of calcification in our cases. The mechanism is unknown.

Samuels reported detection of extraskeletal malignant neoplasms of children with  $^{87\text{m}}\text{Sr}$  scans (2,3). Periosteal reaction was thought to be the cause (2). It was also speculated that the lactic acid accumulated in the tumor as a result of the anaerobic glycolysis, altering pH locally and thus significantly altering local  $^{87\text{m}}\text{Sr}$  affinity (3).

Localization of  $^{87\text{m}}\text{Sr}$  in extraosseous tumors was also reported in adults (4,5). However, there may be differences between  $^{87\text{m}}\text{Sr}$  and  $^{85}\text{Sr}$  scans. Charkes (7) reported false-positive and false-negative findings in  $^{87\text{m}}\text{Sr}$  scans. High blood and extracellular fluid activity within 1 hr after  $^{87\text{m}}\text{Sr}$  injection may result in visualization of the extraosseous tumor whereas a  $^{85}\text{Sr}$  scan, done several days after injection, is free from the false-positive defect (7). However, Chaudhuri, et al have recently reported a case of  $^{87\text{m}}\text{Sr}$  uptake in an extraosseous tumor with low vascularity demonstrated by  $^{113\text{m}}\text{In}$ -transferrin scan (6). In our

cases, the  $^{87}\text{Sr}$  scans were done 3 days after injection. Therefore, the abnormal  $^{85}\text{Sr}$  uptake in the tumor was apparently not due to the high blood concentration of  $^{85}\text{Sr}$ .

Strontium phosphate colloid formation, due to excessive phosphate, caused accumulation of  $^{85}\text{Sr}$  in the reticuloendothelial cells of the liver shortly after injection (8). In Case 1, the  $^{85}\text{Sr}$  uptake was seen only in the area of focal defect shown by  $^{99\text{m}}\text{Tc}$ -sulfur colloid liver scan (Fig. 2B and C). Obviously  $^{85}\text{Sr}$  was not ingested by the Kupffer cells.

Abnormal uptake of  $^{85}\text{Sr}$  due to osseous metaplasia of soft-tissue tumor has been reported (9). There was no evidence of osseous metaplasia in our cases. In both cases, necrosis without calcification was found in the tumor histologically. It may be possible that early undetectable calcification in the necrotic tumor causes the abnormal  $^{85}\text{Sr}$  uptake.

Radiogallium has been used as a bone and tumor scanning agent. There may be sufficient similarity between strontium and gallium in that respect (3). In Case 1,  $^{85}\text{Sr}$  and  $^{67}\text{Ga}$  scans were quite similar. In Case 2, however,  $^{85}\text{Sr}$  but not  $^{67}\text{Ga}$  was concentrated in the tumor (Fig. 2B and D), suggesting that a different mechanism may be involved in the tumor uptakes of  $^{85}\text{Sr}$  and  $^{67}\text{Ga}$ .

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