

FALSE-NEGATIVE ⁷⁵SE-SELENOMETHIONINE SCANS IN PRIMARY LIVER CANCER

Michael C. Kew, Eric W. Geddes, and Joseph Levin

*University of the Witwatersrand, Johannesburg Hospital
and South African Primary Liver Cancer Research Unit, Johannesburg, South Africa*

Selenium-75-selenomethionine and ^{99m}Tc-sulfur colloid scans were performed in 45 Southern African blacks with proven primary cancer of the liver and 28 patients with other space-occupying hepatic lesions. In 6 of the cancer patients, the defect or defects visible on the ^{99m}Tc-sulfur colloid scan were not seen on the ⁷⁵Se-selenomethionine scan, and in 17 patients they had partially disappeared. In the remaining 22 cancer patients and the 28 control patients the two scans were identical. The high incidence of failure of uptake of ⁷⁵Se-selenomethionine by the tumor is attributed to the anaplastic nature of the neoplasm and the frequency with which tumor necrosis occurs in Southern African blacks with primary cancer of the liver.

Primary cancer of the liver (PLC) presents as one or more areas of defective uptake when the liver is scanned with ^{99m}Tc-sulfur colloid or ¹⁹⁸Au-colloid (1,2) but the appearances are indistinguishable from those of other malignant or benign space-occupying hepatic lesions. A possible solution to this problem was suggested by the observation of Ben-Porath, et al (3) that the uptake of ⁷⁵Se-selenomethionine by PLC approached that of surrounding normal liver tissue, a property not shared by other hepatic lesions. The diagnostic value of this scan when combined with a ^{99m}Tc-sulfur colloid scan was confirmed by subsequent workers (4,5). More recently, however, false-negative results have been obtained in 4 of 26 patients studied by the King's College Hospital group (4) and false-positive results with hepatic metastases have also been reported (4,6). Our early experience with the technique suggested that false-negative results may be considerably more common

than this in Southern African blacks with PLC and a formal assessment was therefore undertaken.

PATIENTS STUDIED AND METHODS

Selenium-75-selenomethionine scans (anterior and right lateral) were performed in 73 patients who showed one or more obvious "defects" on a ^{99m}Tc-sulfur colloid scan. A Picker 3-in. and a Siemens 5-in. rectilinear scanner were used and assessments were made on both the photoscan and the colorscan. The dose of ^{99m}Tc-sulfur colloid was 2.0 mCi while that of ⁷⁵Se-selenomethionine was 300 μCi. Scans were recorded 30 min after injection of the radionuclide. Because of the possibility that uptake of ⁷⁵Se-selenomethionine in the "defect" might be delayed, some patients were rescanned after intervals of up to 24 hr.

The series comprised 45 patients with histologically proven PLC and 28 controls. Of the latter, 13 had hepatic metastases (the primary was situated in the breast in 3 patients, large bowel and stomach in 2 each, lung and kidney in 1 each, and was unknown in 4), 8 an amoebic liver abscess, 3 cirrhosis (7) and 1 each a giant cavernous hemangioma, hydatid cysts, tuberculomata, and a large benign cyst of unknown cause. To insure an objective assessment of the scans, all 73 were examined by two of the authors (MCK and JL) without knowing which of the patients had PLC and which were controls. Simple visual comparisons between the ^{99m}Tc-sulfur colloid and ⁷⁵Se-selenomethionine scans were made without any attempt to calculate the differences in uptake of the two radionuclides in the "defects".

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For reprints contact: Michael C. Kew, Dept. of Medicine, Witwatersrand Medical School, Hospital Hill, Johannesburg, South Africa.

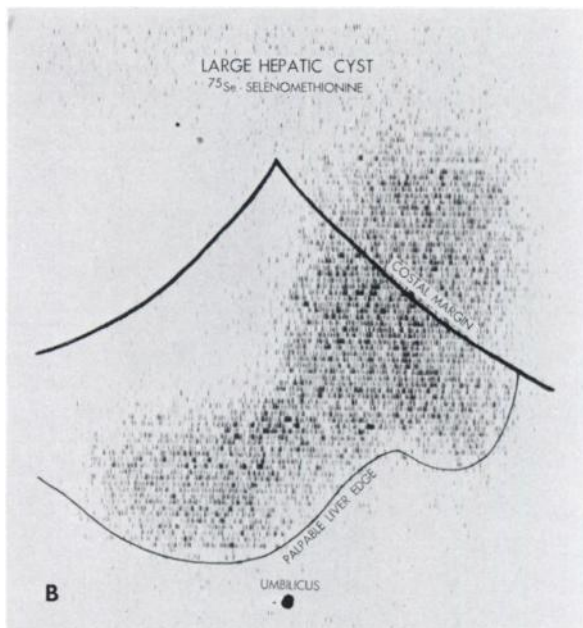
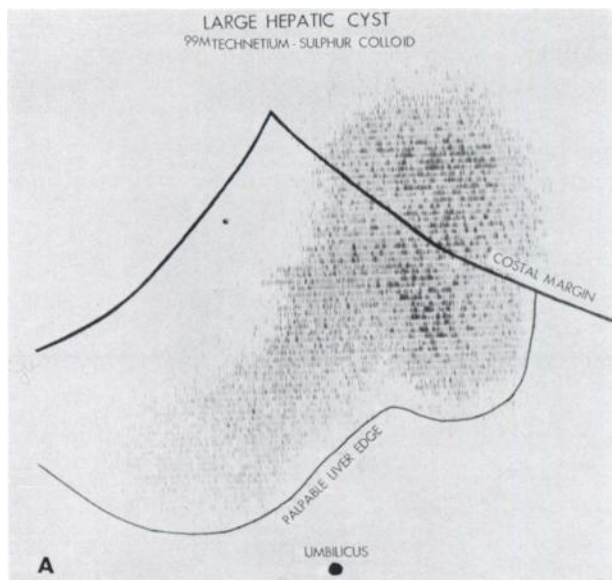


FIG. 1. Identical ^{99m}Tc -sulfur colloid (A) and ^{75}Se -selenomethionine (B) scans in patient with large benign hepatic cyst.

RESULTS

In the 28 patients with hepatic lesions other than PLC, the ^{99m}Tc -sulfur colloid and ^{75}Se -selenomethionine scans were identical (an example is shown in Fig. 1). In 6 of the 45 patients with PLC the "defect" on the ^{99m}Tc -sulfur colloid scan had completely disappeared on the ^{75}Se -selenomethionine scan (Fig. 2) and in 17 it had partially disappeared (Fig. 3); in the remaining 22 patients (49%), the two scans were identical (Fig. 4). There was no significant change in the scintiscan picture when some of the patients were rescanned at intervals of up to 24 hr after injection of ^{75}Se -selenomethionine.

DISCUSSION

Selenium-75-selenomethionine is formed by substitution of ^{75}Se for the sulfur atom in methionine. It is thought to follow the same metabolic pathways as the parent substance, and its incorporation into a tissue is therefore determined by the tissue's blood supply and its capacity to metabolize methionine (6).

The morphology of well-differentiated PLC may closely resemble that of normal liver tissue and the malignant cells retain some of the functions of normal hepatocytes; for example, the ability to secrete bile (8,9). Moreover, PLC is usually highly vascular. It is therefore not surprising that the uptake of ^{75}Se -selenomethionine by PLC can approach that of surrounding normal liver tissue and that the use of this radionuclide should enhance the diagnostic accuracy of liver scintigraphy in hepatic malignancy.

On the other hand, very anaplastic or necrotic tumors would not be expected to take up ^{75}Se -selenomethionine, and the resulting scan picture

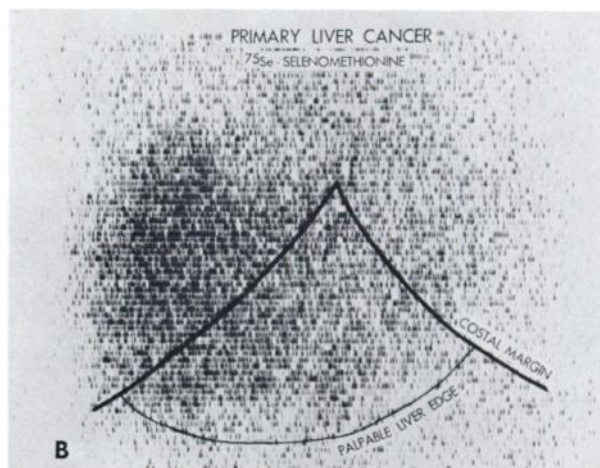
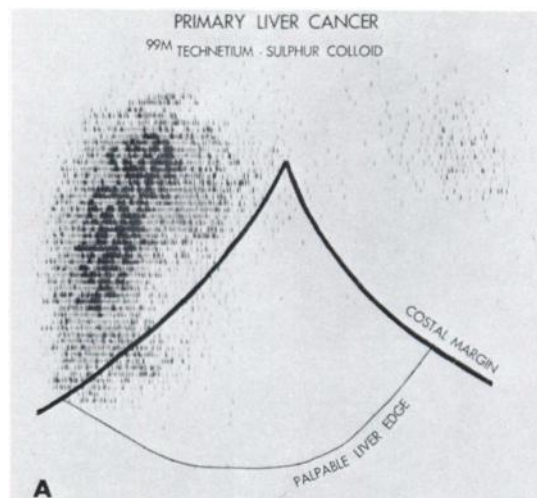


FIG. 2. Defects present on ^{99m}Tc -sulfur colloid scan (A) are not seen on ^{75}Se -selenomethionine scan (B).

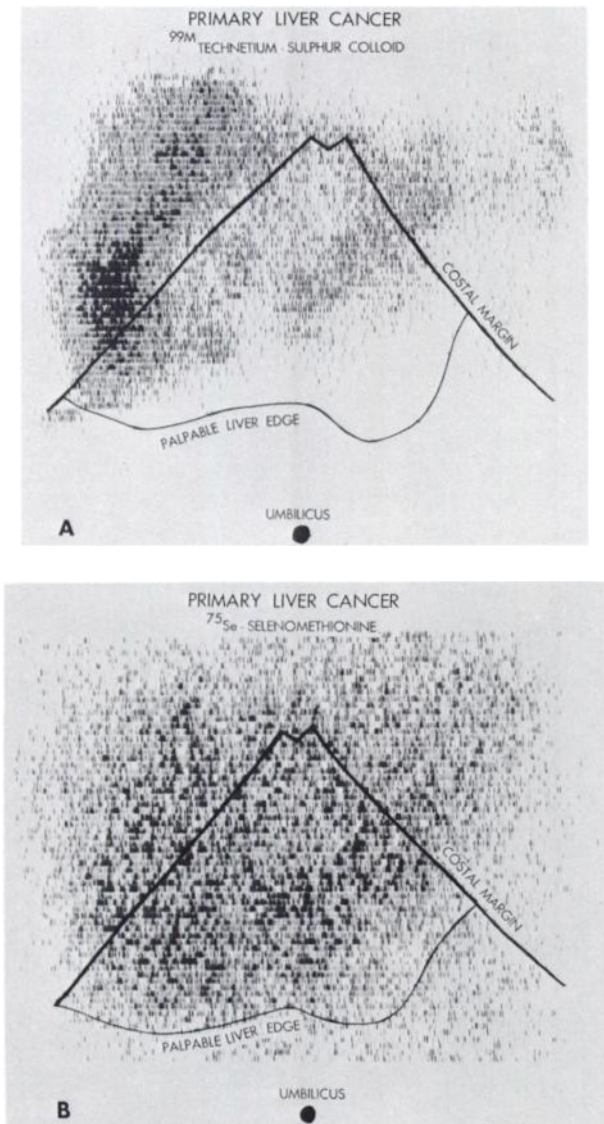


FIG. 3. Partial uptake of ^{75}Se -selenomethionine (B) by primary liver cancer in comparison with no uptake of $^{99\text{m}}\text{Tc}$ -sulfur colloid (A).

would be identical with that obtained with $^{99\text{m}}\text{Tc}$ -sulfur colloid. PLC in Southern African blacks usually runs a very fulminating course and death frequently occurs within 4 months of the onset of symptoms (10). The tumor is frequently anaplastic and is often necrotic at autopsy (10). These facts provide a likely explanation for the finding of false-negative results in one-half of our patients.

Some uptake of ^{75}Se -selenomethionine by hepatic metastases from a variety of primary sites has been reported (4,6). This presumably reflects the ability of neoplastic cells from these sources to metabolize methionine, provided they have a sufficient blood supply. No false-positive results were observed in the present series.

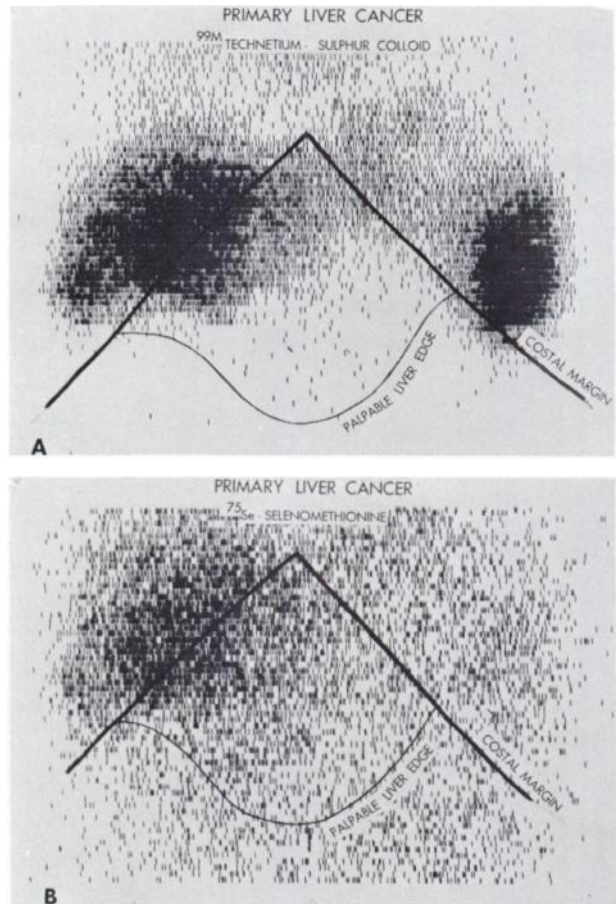


FIG. 4. No significant difference between uptake of $^{99\text{m}}\text{Tc}$ -sulfur colloid (A) and that of ^{75}Se -selenomethionine (B) in patient with primary liver cancer.

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