FALSE-POSITIVE ^{75}Se-SELENITE SCAN IN NONMALIGNANT LESIONS

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Several reports describe ^{75}Se-selenite as an excellent tumor tracer. However, the study of the tracer accumulation of ^{75}Se-selenite in animals with nonmalignant lesions (necrotic lesion and infectious abscess in the muscle) shows even higher concentration ratios in comparison with induced mammary tumors. Moreover, ^{75}Se-selenite brain scintigraphy gives no reliable information for differential diagnosis of benign or malignant cerebral pathology. Frequently cerebral infarcts are visualized on brain scan using the aforementioned tracer substances. From experimental and clinical data it appears that ^{75}Se-selenite has only limited value as tumor-specific tracer.

The possibilities of ^{75}Se-selenite as a tumor-localizing agent are described in numerous studies which mention positive scintigraphic visualization of tumors in brain, liver, bone, and many other organs or tissues (*1–5*). We were particularly interested in the use of ^{75}Se-selenite for the differential diagnosis of intracerebral processes. As described by some authors (*2*) the use of ^{75}Se-selenite differentiates better between brain tumors and vascular lesions than either ^{99m}Tc-pertechnetate or ^{197}Hg-chlormerodrin. The results of other studies (*5*) indicate that the occurrence of positive ^{75}Se-selenite accumulation in nonmalignant cerebral diseases is rather unusual. Our clinical experience and the results of animal experience urged us, however, to warn against excessive confidence in the possibilities of ^{75}Se-selenite scans for the differential diagnosis between malignant and nonmalignant lesions.

EXPERIMENTAL DATA

The detailed study of tracer concentration in mammary tumors induced in young Sprague-Dawley rats by feeding DMBA according to the method described by Shimkin (*6*), was followed by similar measurements in nonmalignant lesions. Some animals presented a necrotic zone in the muscles of the hind leg (due to the injection of a mixture of camphor alcohol and turpentine oil); others showed an abscess (after intramuscular insertion of an infected silk thread—Staphylococcus aureus). Fifty-seven animals were investigated: 21 with mammary cancer, 18 with necrotic lesions, and 18 with staphylococcus abscesses. The tracer concentration in the lesions and reference tissues was determined at 24, 48, and 72 hr after injection of the tracer-substance (see Tables 1 and 2). The radioactive accumulation was expressed as a percent of the administered dose of radioactivity per 1% of the body weight. In addition, the tracer distribution in both hind legs of the rats was visualized by using the gamma camera with pinhole collimator. Scintigraphy revealed all fresh necrotic or infectious lesions (Fig. 1).

DISCUSSION

The concentration of ^{75}Se-selenite in the above-described nonmalignant lesions is even higher than in tumors with higher concentration ratios versus reference tissues, resulting in easily discernible hot zones at scintigraphy.

CLINICAL DATA

The ^{75}Se-selenite brain scan was performed in 58 patients (Table 3). The scan was performed 24 hr after injection of the tracer doses.

The gamma camera (Pho/Gamma III) with 1,600 channel analyzer was used for the visualization of intracranial tracer distribution. Tumors are readily detected using ^{75}Se-selenite (two cases with metas-

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TABLE 1. ^{75}Se-SELENITE ACCUMULATION IN % DOSE/1% BODY WEIGHT IN SPRAGUE-DAWLEY RATS

	At 24 hr	At 48 hr	At 72 hr
Whole blood	1.15 ± 0.063	1.011 ± 0.01	0.94 ± 0.02
Muscle	0.159 ± 0.021	0.142 ± 0.068	0.144 ± 0.0001
Brain	0.115 ± 0.006	0.12 ± 0.08	0.11 ± 0.010
Tumor	0.97 ± 0.14	1.00 ± 0.28	0.86 ± 0.06
Necrotic lesion (8 days old)	1.29 ± 0.04	0.79 ± 0.05	1.20 ± 0.041
Necrotic lesion (2 weeks old)	0.44 ± 0.03	0.41 ± 0.02	0.55 ± 0.02
Staphylococcus abscess (8 days old)	1.03 ± 0.015	0.94 ± 0.02	1.13 ± 0.02
Staphylococcus abscess (1 month old)	1.23 ± 0.19	1.13 ± 0.12	0.8 ± 0.02

TABLE 2. RATIO OF TRACER CONCENTRATION OF LESION VERSUS REFERENCE TISSUES

	At 24 hr	At 48 hr	At 72 hr
Mammary tumors			
tumor/brain	8.43	8.33	7.81
tumor/muscle	6.10	7.04	5.97
tumor/blood	0.84	1.01	0.91
Necrotic lesion (8 days old)			
necrotic lesion/brain	11.21	6.58	10.9
necrotic lesion/muscle	8.11	5.56	8.33
necrotic lesion/blood	1.12	0.78	1.27
Necrotic lesion (2 weeks old)			
necrotic lesion/brain	3.82	3.41	5.00
necrotic lesion/muscle	2.76	2.88	3.81
necrotic lesion/blood	0.38	0.40	0.58
Staphylococcus abscess (8 days old)			
abscess/brain	8.95	7.83	10.27
abscess/muscle	6.47	6.61	7.84
abscess/blood	0.89	0.93	1.20
Staphylococcus abscess (1 month old)			
abscess/brain	10.69	9.41	7.27
abscess/muscle	7.73	7.95	5.55
abscess/blood	1.07	1.11	0.85

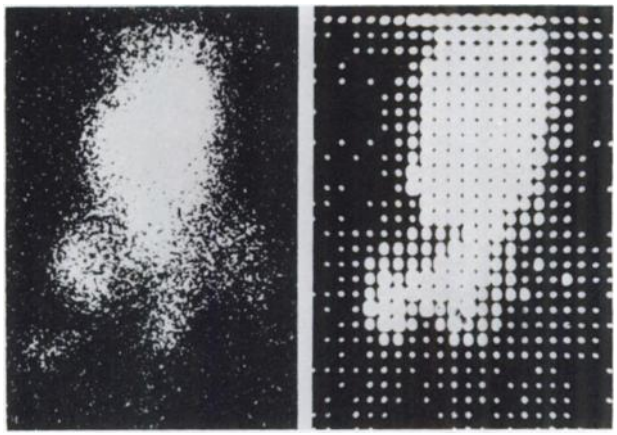

FIG. 1. Necrotic lesion in hind leg of Sprague-Dawley rat, visualized by ^{75}Se selenite (triple lens and multichannel Polaroid images).

TABLE 3. RESULTS OF ^{75}Se-SELENITE AND ^{99m}Tc-PERTECHNETATE BRAIN SCANS

		Scan positive		Scan negative	
		^{75}Se-selenite	^{99m}Tc-pertechnetate	^{75}Se-selenite	^{99m}Tc-pertechnetate
Tumors	32	30	30	2	2
Probably tumors	2	2	2	—	—
Cerebrovascular disease	16	9	12	7	4
Without intracerebral lesion	4	—	—	4	4
Angioma	1	—	1	1	—
Nonproved meningioma	2	—	1	2	1
Trauma	1	1	1	—	—

tases were missed). Contrary to the generally accepted opinion, we found a large percentage of positive scans in patients with cerebrovascular disease. In eight cases with cerebral infarct, both ^{75}Se-selenite and ^{99m}Tc-pertechnetate scans were positive with practically identical tracer distribution in six cases (Fig. 2). In two cases the ^{75}Se-selenite scintigraphy was negative whereas the ^{99m}Tc-pertechnetate scan showed a hyperactive zone. In chronic diffuse cerebral vascular disease (five cases) radioactive selenite scintigraphy was negative in three cases, but there were also two cases with both ^{75}Se and ^{99m}Tc scans positive. A very long followup (3 years) of the aforementioned patient group with cerebrovascular disease excluded any possibility of failure to recognize a brain tumor. The three cases, in addition to eight cases with cerebral infarct and five cases with diffuse cerebrovascular disease, presented intracerebral hematoma.

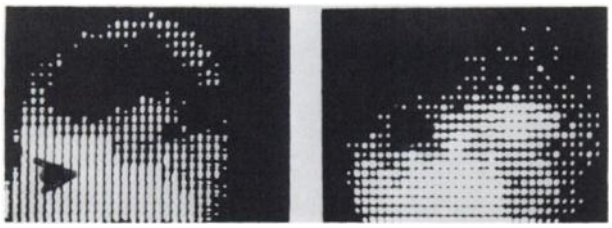

FIG. 2. Patient with cerebral infarct. Hyperactive focus in left temporal lobe, visualized by ^{99m}Tc-pertechnetate (left image) as well as by ^{75}Se-selenite (right image).

DISCUSSION

We were not able to confirm the data of others (*5*) concerning the usefulness of ^{75}Se-selenite scans for the differentiation of cerebral tumors from vascular disease. Cerebral infarcts, especially during the hyperemic phase, present pathological accumulation in both ^{75}Se and ^{99m}Tc scans. Even in chronic vascular disease of the brain, positive ^{75}Se-selenite scintigraphies occur.

The isotopic visualization of tumors cannot be considered as specific and no hitherto known "tumor" tracer provides an exception to that rule. Necrotic zones and abscesses present a high ^{75}Se-selenite tracer accumulation as shown in Sprague-Dawley rats. In the particular case of brain scans with ^{75}Se-selenite even nonmalignant disease (cerebral infarct) shows high tracer accumulation, possibly due to hypervascularization. The differential diagnosis between brain tumor and nonmalignant disease remains doubtful with this tracer substance.

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