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The Anatomical Correlation of the Abnormal RIHSA Brain Scan[1]

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Although the exact reason for the accumulation of radio-iodinated human serum albumin (RIHSA) in pathological tissues is as yet unknown, this phenomenon is usually associated with the presence of focal intracranial disease. If brain scanning is performed in crossed axes, these abnormal concentrations of RIHSA can be localized within the cranium and measured in terms of their length, width and breadth. Mass lesions such as neoplasms, hematomas, and abscesses, as well as acute vascular infarcts and arrterio-venous malformations are the types of pathology most frequently detected (1-4).

In 1961, Di Chiro indicated that certain lesions visualized by RIHSA brain scanning ultimately proved to have approximately the same dimensions as the actual lesions themselves (5). He restricted his analysis to meningiomas and a few other discrete, long standing tumors, mentioning the difficulties that might be encountered in evaluating the more protean but quite common forms of intracranial disease. Although a correlation of scan abnormalities with the anatomy and dimensions of other types of intracranial disease would also have been of interest, no further systematic effort has been made in this direction to date.

This report compares the localization and size of lesions diagnosed by means of RIHSA brain scanning with the autopsy findings in a series of unselected cases.

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METHODS AND MATERIALS

The anatomical position and size of intracranial lesions were determined in 28 consecutive autopsy cases where RIHSA brain scanning was performed. Two cases proved unsuitable for inclusion. In one case, scanning was technically unsatisfactory. In the other case, scanning was performed five weeks prior to an acute cerebro-vascular occlusion.

Measurements of the lesions visualized by brain scanning were taken in the anterior-posterior, transverse, and rostral-caudal planes in order to coincide with the manner of post mortem examination. Scans were performed in both anterior and appropriate lateral views. Further technical details are as described

TABLE I

INCIDENCE OF ABNORMAL RIHSA BRAIN SCANS IN CONSECUTIVE AUTOPSIED CASES

Pathology	*No. cases*	*No. abnormal scans*
I Aneurysm	1	0
II Encephalomalacia	4	0
III Hematoma, intracerebral	1	1
IV Neoplasm	20	16

TABLE II

RESULTS OF RIHSA BRAIN SCANS IN AUTOPSIED CASES WITH INTRACRANIAL NEOPLASMS

Number of cases	*Pathologic Classification*	*Scan*	
		Positive	*Negative*
6	Glioblastoma	5	1
3	Meningioma	3	0
9	Metastatic Carcinoma	8	1
1	Metastatic Melanoma	0	1
1	Chondrosarcoma	0	1
—		—	—
20	TOTAL	16	4

in a prior publication by one of us (M.B.) (6). The intracranial position of the lesions was deduced by use of anterior and lateral scans and the landmarks placed on the scans.

In most cases, both immediate and delayed (48 hour) scans were available. Delayed photo-scans were used in this study except in two patients with meningiomas where only immediate studies were obtained and in one case of glioblastoma (H.S.) where only a 24 hour study was available.

RESULTS AND DISCUSSION

Table I reviews the types of pathological lesions encountered in the 26 autopsied cases and indicates the incidence of abnormal RIHSA brain scans.

I *Aneurysm.* A patient with two aneurysms of the Circle of Willis expired after repeated sub-arachnoid hemorrhages. The brain scan was negative.

II *Encephalomalacia.* Multiple areas of encephalomalacia were encountered in four patients with negative brain scans. Although these patients all manifested neurological signs and symptoms, the cause of death in each case was not primarily neurological.

III *Intracerebral Hematoma.* A single patient proved to have a chronic intracerebral hematoma and an adjacent recent hemorrhage. Brain scanning performed shortly following admission, two months prior to the patient's demise, revealed a diffuse lesion which involved the posterior half of the brain. The anterior scan indicated a focal abnormality with a central area of diminished uptake (Figure 1).

TABLE III

MENINGIOMA

Anatomic Correlation of RIHSA Brain Scans With the Post Mortem Findings

Case	*Scan-PM interval (days)*	*Scan size (cm)*	*PM size (cm)*	*Scan localization*	*PM localization*
G.Z.	1	4 x 5 x 4 *	6 x 5 x 5	mid frontal, parasagittal	anterior midfrontal, parasagittal
E.A.	6	5 x 4 x 6 *	**	mid & posterior temporal	mid temporal
B.J.	13	6 x 6 x 6	6 x 7	parieto-occipital	parieto-occipital

*Immediate scan

**Resected

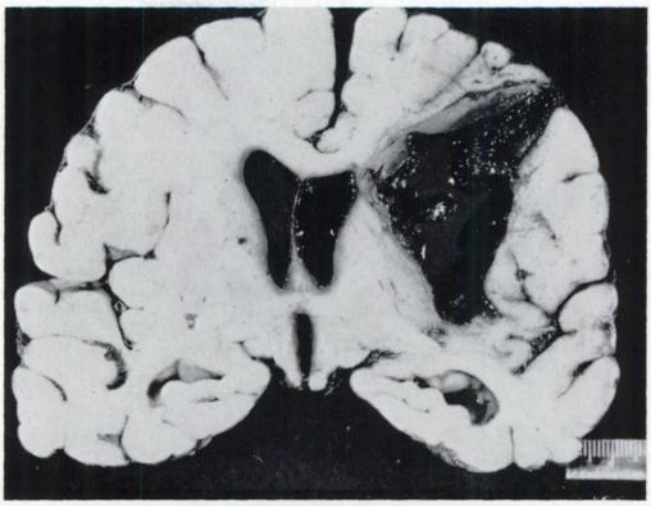

Fig. 1a. (T.R.) Coronal section showing old intracerebral hematoma of the right parietal lobe and an adjacent recent hemorrhage with rupture into the right lateral ventricle.[1]

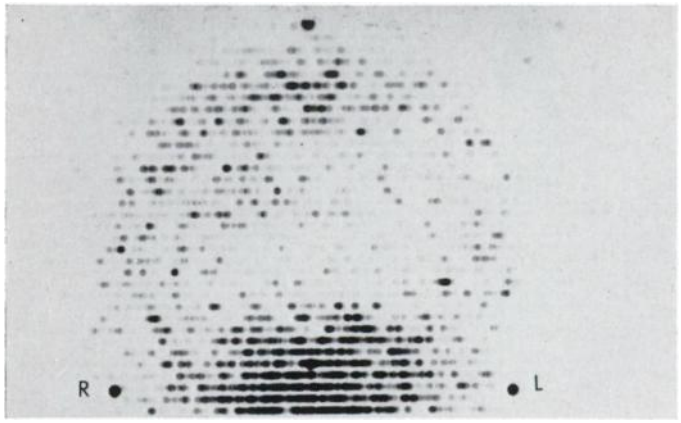

Fig. 1b. Anterior lateral brain scan, (Fig. 1a).

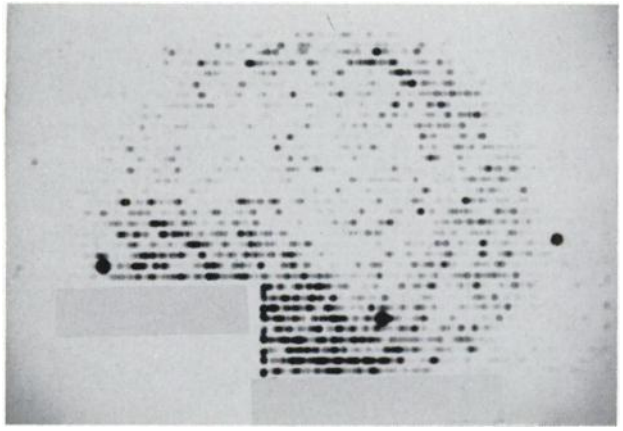

Fig. 1c. Right lateral brain scan, (Fig. 1a).

[1]In all illustrations of the pathological anatomy, the ruler is on the right.

IV *Neoplasm.* Twenty patients proved to have intracranial neoplasms. Table II indicates the types of neoplasms and the results of brain scanning in each category.

A. *Chondrosarcoma.* Scanning was negative in a case of chondrosarcoma which invaded the sphenoid sinus and sella turcica.

B. *Metastatic Melanoma.* Scanning was negative in a case of metastatic melanoma with many small lesions disseminated throughout the brain and meninges. None of these lesions was more than 2 cm in diameter.

C. *Meningioma.* Brain scanning correctly localized the three meningiomas in this autopsy series. The sizes of the lesions seen on the scans were comparable to the actual sizes of the meningiomas, Table III.

Experience with an additional 21 surgically verified cases of meningioma detected by RIHSA brain scanning indicated that these lesions

TABLE IV
GLIOBLASTOMA
Anatomic Correlation of RIHSA Brain Scans With the Post Mortem Findings

Case	*Scan-PM interval (days)*	*RT*	*Scan size (cm)*	*PM size (cm)*	*Scan localization*	*PM localization*
R.R.	6		4 x 3 x 5	7 x 6 x 5	posterior temporal	temporal*
H.S.	13		5 x 3 x 3	6 x 4 x 4	mesial posterior frontal	corpus callosum and thalamus
E.J.	24		—	**	——	trigone, corpus callosum, temporal bilateral parietal
J.F.	31		5 x 5 x 4	***	inferior mid frontal	inferior mid frontal
G.L.	55		3 x 4 x 3	8 x 7 x 5	mesial mid frontal	insula, mid frontal corpus callosum opposite caudate
He.S.	128	x	3 x 3 x 3	5 x 3 x 3	posterior frontal	posterior frontal central grey

*Fresh hemorrhage
**Diffuse and invasive
***Resected

usually proved to be of approximately the size seen on the scan. However, detailed analysis of surgical material is precluded by the fact that many of these tumors were partially resected or fragmented.

D. *Glioblastoma.* Five of six glioblastomas were correctly localized by brain scanning and proved to be of approximately the same size seen on the scan (Table IV). Examples of the anatomic correlation of the brain

TABLE VA

METASTATIC CARCINOMA

Anatomic Correlation of RIHSA Brain Scans With the Post Mortem Findings (11-38 Days Scan-PM Interval)

Case	*Scan-PM interval (days)*		*Scan size (cm)*	*PM size (cm)*	*Scan localization*	*PM localization*
		RT				
J.D.	11	x	5 x 5	4 x 4	parietal	parietal, central white
R.B. † (1)	18		4 x 4 x 5	6 x 6 x 6	parieto-occipital	parieto-occipital
(2)			—	2.5 x 2.5	——	opposite thalamus
D.G.	29	x	5 x 5 x 6	4 x 5 x 6	parietal	inferior parietal posterior temporal
A.S.	30	x	—	(?) 3 x 4	——	posterior frontal-parietal
S.B.	32	x	4 x 5 x 5	4 x 5	parietal	parietal
P.E. (1)	38		5 x 3 x 3	*	mesial inferior frontal	frontal
(2)			—	4 x 3 x 3	——	cerebellum
(3)			—	<1 cm.	——	multiple cerebral

†Autopsy performed by Medical Examinter
*Resected

scan abnormality are shown in Figures 2, 3. Measurements in one case (R.R.) reflect the inclusion of a preterminal hemorrhage. The single tumor in this group not detected by scanning was an infiltrating type of growth which invaded the deep structures of the right side of the brain with extension to the left side as well (Figure 4).

E. *Metastatic Carcinoma.* Scanning correctly localized lesions in eight of the nine autopsied cases with metastatic carcinoma. In cases with multiple metastases, intracerebral lesions under 2.5 cm in diameter were usually not detected. A large lesion in the posterior fossa measuring

TABLE Vb

METASTATIC CARCINOMA

Anatomic Correlation of RIHSA Brain Scans With the Post Mortem Findings (87-168 Day Scan-PM Interval)

Case	*Scan-PM interval (days)*		*Scan size (cm)*	*PM size (cm)*	*Scan localization*	*PM localization*
		RT				
S.S. (1)	87	x	4 x 3 x 4	2 x 2 x 2	parieto-occipital	occipital, para-sagittal
(2)			2 x 2	—	frontal, para-sagittal	*
(3)			—	<1 cm.	——	multiple cerebral
E.B. (1)	108	x	2 x 2 x 2	3 x 2 x 2	mid posterior frontal	mid posterior frontal
(2)			—	2 x 3 x 1	——	superior parietal lobule, ipsilateral
G.K. (1)	168	x	2 x 3 x 3	3 x 3	mesial mid frontal	central mid frontal
(2)			—	<1 cm.	——	multiple cerebral

*Skull metastases

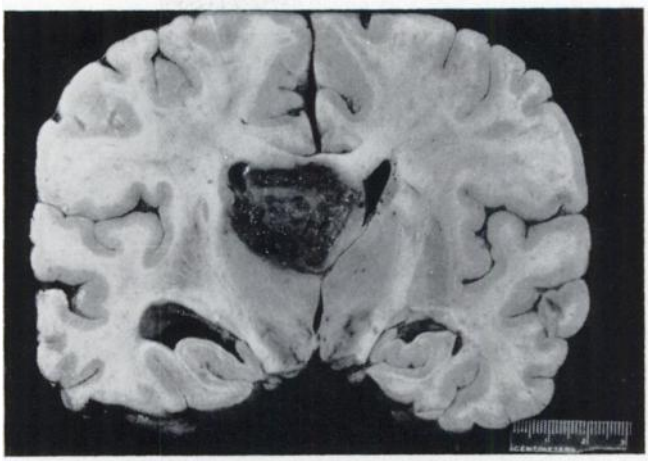

Fig. 2a. (H.S.) Coronal section showing a glioblastoma of the corpus callosum and left thalamus.

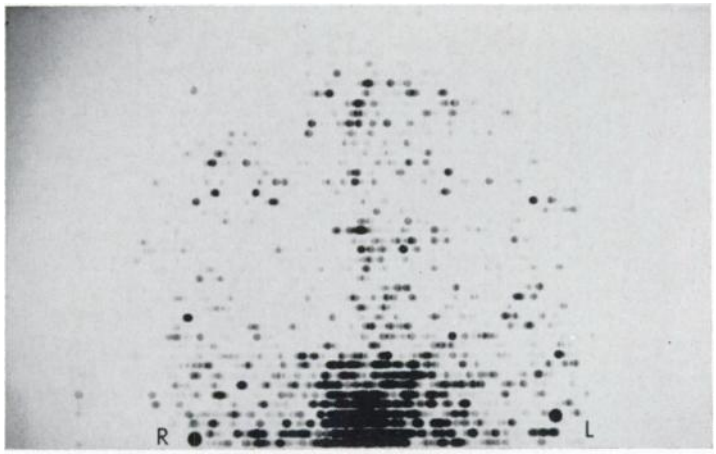

Fig. 2b. Anterior brain scan, Fig. 2a.

Fig. 2c. Left lateral brain scan, Fig. 2a.

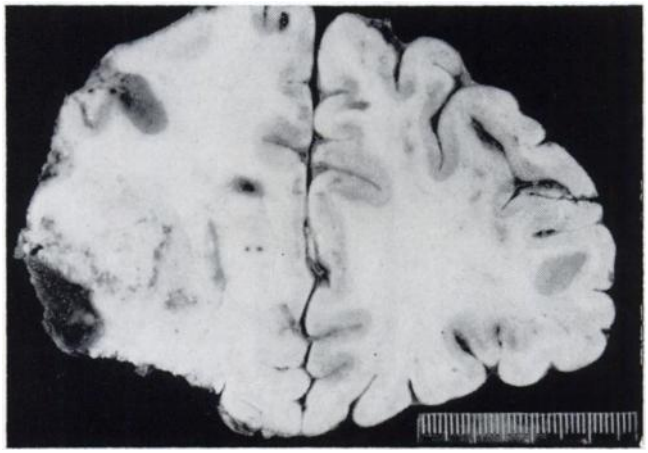

Fig. 3a. (J.F.) Coronal section at the level of the tip of the frontal horn demonstrating a glioblastoma in the inferior lateral quadrant of the left frontal lobe.

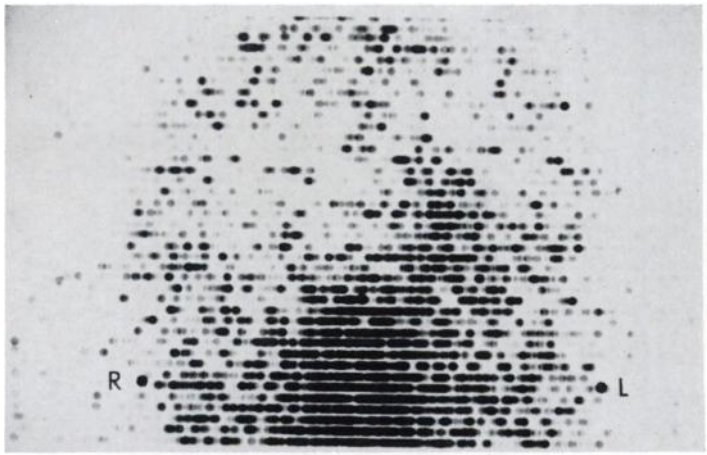

Fig. 3b. Anterior brain scan, Fig. 3a.

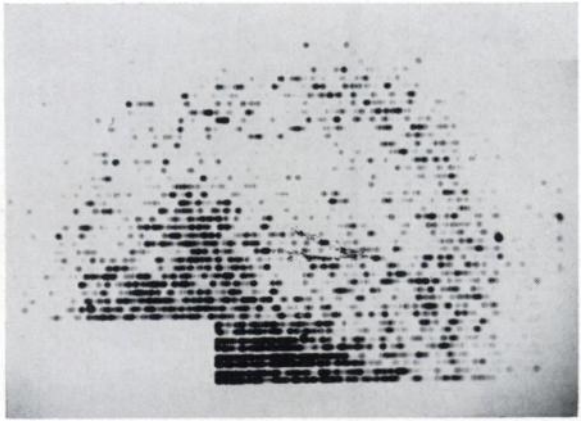

Fig. 3c. Left lateral brain scan, Fig. 3a.

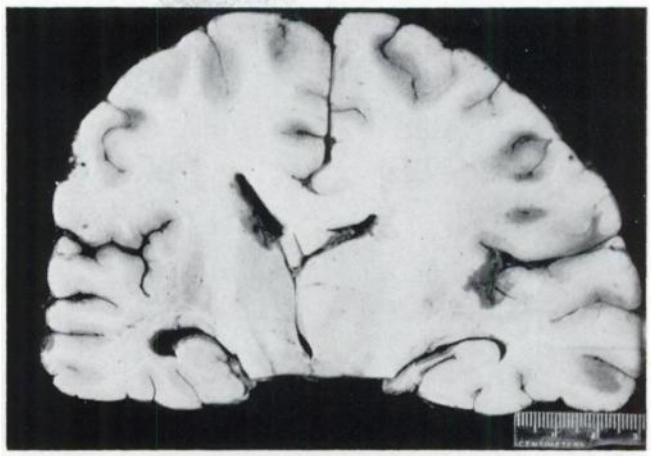

Fig. 4a. (E.J.) Coronal section showing enlargement of the right thalamus, fornices, corpus callosum, and the right parietal and temporal lobes, all of which regions on histologic examination contained infiltrating glioblastoma. Brain scan was negative in this case.

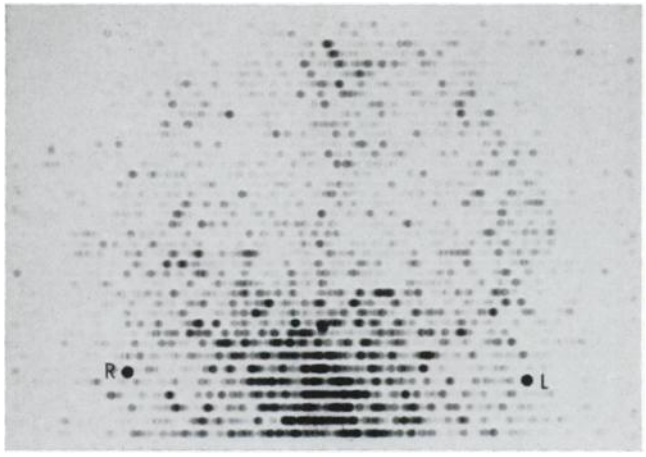

Fig. 4b. Anterior brain scan, Fig. 4a. The scan is within normal limits.

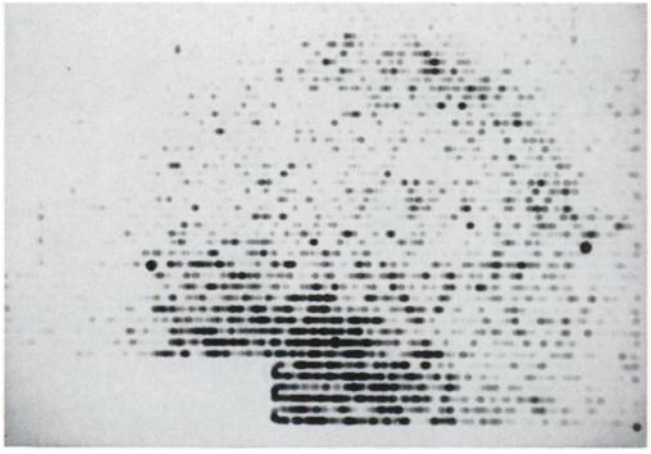

Fig. 4c. Right lateral brain scan, Fig. 4a. The scan is within normal limits.

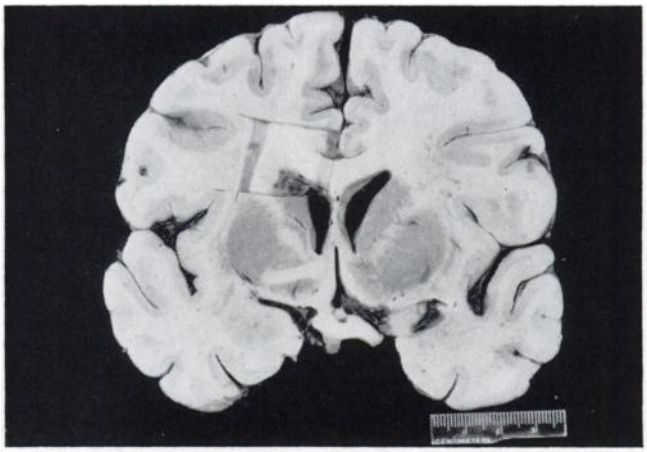

Fig. 5a. (G.K.) Coronal section showing a metastatic carcinoma in the supero-lateral portion of the head of the caudate and adjacent white matter of the left frontal lobe.

Fig. 5b. Anterior brain scan, Fig. 5a.

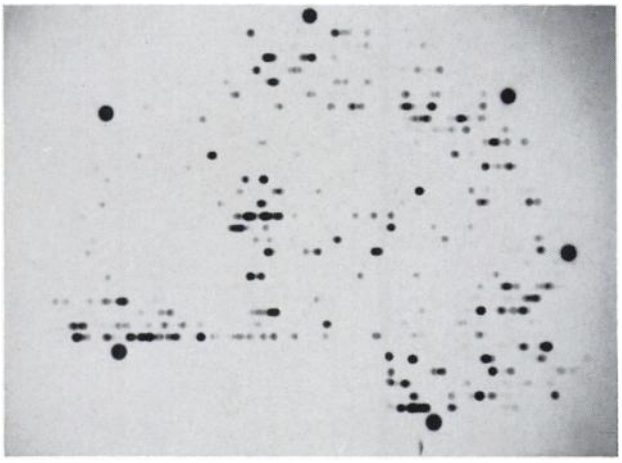

Fig. 5c. Left lateral brain scan, Fig. 5a.

$4 \times 3 \times 3$ cm was also not detected. Despite protracted clinical courses and intercurrent radiation therapy, the position and size of the lesions detected by brain scanning were in general agreement with the findings at the time of autopsy (Tables Va, Vb). An example is shown in Figure 5. In one case (S.S.), a scan abnormality in the frontal parasagittal region could not be confirmed. Numerous lytic lesions of the skull had been noted on x-ray examination in this case, but the calvaria was not available for study.

CONCLUSION AND SUMMARY

Comparison of the results of RIHSA brain scanning with the pathological findings in autopsied cases of meningioma, glioblastoma, and metastatic carcinoma, as well as in a single case of intracerebral hematoma, demonstrates the accuracy of localization of intracranial lesions by means of radioisotope examinations.

Despite complicating factors such as terminal hemorrhage, protracted clinical courses, and radiotherapy, the general estimation of the diameters of intracranial lesions by means of scanning usually proved to be within 1-2 cm of the actual measurements at the time of autopsy.

Lesions below 2.5 cm in diameter were usually not delineated by brain scanning. In addition, an even larger lesion in the posterior fossa eluded detection. Scanning was negative in a case of an infiltrating glioblastoma and in a case with a chondrosarcoma at the base of the skull. Cases with multiple areas of encephalomalacia and a case with multiple aneurysms also had negative scans.

These findings suggest that wider use of the abnormal brain scan should be made for the localization of lesions at the time of biopsy of the brain or for field localization if selective radiation therapy is planned.

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