JOURNAL OF NUCLEAR MEDICINE 5:189-192, 1964

The Value of Brain Scans in the Management of Suspected Intracranial Lesions[1].

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ABSTRACT

Review of 111 brain scans done at the University of Colorado Medical Center before March 1963 showed 30 patients who had surgical or autopsy proof of space occupying, intracranial lesions. Of these 30, 21 were correctly diagnosed, and 9 were missed. There were 22 positive scans, of these 21 were in patients from whom histologic proof was obtained, and 1 was lost to follow up. These results suggest the following:

1.) Positive scans can be used to make a diagnosis of intracranial lesions with a high degree of reliability.
2.) Negative scans do not exclude the diagnosis.
3.) Scans are most valuable when used as a screening technique.

INTRODUCTION

Brain scanning requires expensive equipment and exposes patients and personnel to ionizing radiation. There must be some benefit gained from the procedure, not available from more conventional techniques, to justify the expense and exposure. The purpose of this report is to discuss the value of this examination as the earliest special diagnostic technique.

INSTRUMENTATION

A Picker Magnascanner with a thallium activated sodium iodide crystal, focusing collimator and both dot and photo recording was used. The pattern of scanning was rectilinear with a rate of travel of 28 cm/min. and 0.4 cm separation of sweeps. Scans were made in planes parallel to both coronal and sagittal planes. The background range differentiation was 40 per cent on the photo recording and 8 per cent background cut off on the dot recording.

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TECHNIQUES

a.) Neohydrin – Hg^{203}, 10 microc/Kg body weight, was given intravenously and scans made 4 hours later. A commercial mercurial diuretic (non-radioactive) was given intramuscularly 24 hours before the examination to protect the kidneys (1,2).

b.) I^{131} HSA, 5 microc/Kg body weight, was given intravenously and scans made as soon as possible, at 24 hours, and 48 hours after injection. Saturated solution of potassium iodide, 10 drops by mouth in the adult, was given 24 hours before the examination to block the thyroid (4,6).

Because the gamma photon emitted by Hg^{203} is in the optimum energy range for efficient detection, and because the effective half life of Neohydrin – Hg^{203} is very short, this compound was preferred for the procedure (1, 2,3).

METHODS AND MATERIALS

The scans of all patients referred to the radioisotope laboratory for brain scans are included in the study. All scans were reviewed by several staff radiologists, all familiar with the procedure. Only 1 scan originally interpreted as negative was considered positive on review. A positive diagnosis of a space occupying, intracranial lesion was made only from evidence of an abnormal, fairly well localized increase in the concentration of the radioactive material. Areas of decreased concentration were not considered significant.

RESULTS

Of the 111 brain scans made, 22 were considered positive. All but 1 had histologically proved intracranial lesions at surgery or autopsy. This patient left

TABLE I

SUMMARY OF ALL BRAIN SCANS

SURGICALLY PROVED LESIONS

Positive Scans	21	
Negative Scans	9	
Total	30	
All Scans		
Positive Scans		
With Proved Lesions	21	
False Positive	1	
Total		22
Negative Scans		
With Proved Lesions	9	
Surgically Negative	3	
Clinically Negative	77	
Total		89
Total Scans		111

the hospital against medical advice and was lost to follow up. Of the remaining 89 scans, interpreted as negative, 9 had histologic proof of space occupying lesions and 3 had lesions of a non-space occupying nature (laceration of the dura, generalized cerebral edema, benign diploic tumor) at surgery or autopsy. There were, then, 30 proved space occupying, intracranial lesions of which 21 were demonstrated by brain scans.

Table I summarizes all examinations. All cases treated surgically or that came to autopsy are listed in Table II.

DISCUSSION

In this series, interpreting only an abnormal increase in concentration in a localized area as positive, positive scans were very accurate. By these criteria, 9 of 30 patients with proved intracranial tumors had scans interpreted as negative.

TABLE II

PROVED CASES, SURGERY OR AUTOPSY

	Positive Scans			*Negative Scans*		
	Isotope	Diagnosis*	Proof	Isotope	Diagnosis*	Proof
1.	Hg^{203}	Astrocytoma III	Surgery	Hg^{203}	Astrocytoma IV	Surgery
2.	Hg^{203}	Astrocytoma III	Autopsy	Hg^{203}	Astrocytoma III	Autopsy
3.	Hg^{203}	Astrocytoma III	Autopsy	Hg^{203}	Astrocytoma III	Surgery
4.	Hg^{203}	Astrocytoma III	Surgery	Hg^{203}	Astrocytoma I	Surgery
5.	Hg^{203}	Astrocytoma III	Surgery	Hg^{203}	Astrocytoma I	Surgery
6.	Hg^{203}	Astrocytoma III	Surgery	Hg^{203}	Medullablastoma	Autopsy
7.	I^{131}	Astrocytoma III	Surgery	Hg^{203}	Metastases Melanoma 1°	Autopsy
8.	H^{203}	Astrocytoma I	Surgery			
9.	I^{131}	Astrocytoma I	Surgery	Hg^{203}	Metastases Melanoma 1°	Autopsy
10.	Hg^{203}	Medullablastoma	Surgery			
11.	I^{131}	Medullablastoma	Surgery	Hg^{203}	Meningioma	Surgery
12.	Hg^{203}	Metastatic Ca. Colon 1°	Surgery	Hg^{203}	Laceration of the Dura	Surgery
13.	Hg^{203}	Metastatic Ca. Colon 1°	Surgery	Hg^{203}	Generalized Cerebral Edema	Surgery
14.	I^{131}	Metastatic Ca. Lung 1°	Surgery	Hg^{203}	Diploic Tumor	Surgery
15.	Hg^{203}	Metastatic Ca. Lung 1°	Surgery			
16.	Hg^{203}	Acoustic Neurinoma	Surgery			
17.	Hg^{203}	Meningioma	Surgery			
18.	Hg^{203}	Meningioma	Surgery			
19.	I^{131}	Meningioma	Surgery			
20.	I^{131}	A-V Malformation	Surgery			
21.	Hg^{203}	A-V Malformation	Surgery			

*Kernohan's Classification

Therefore, as suggested by this series, this examination can be used to make a definitive diagnosis that a lesion is present, but it should not be used in the converse sense; *i.e.*, negative scans should not imply exclusion of intracranial pathology. In this series a positive interpretation could have been used to avoid some of the air studies, angiograms and lumbar punctures, all of which have been shown to have significant morbidity and mortality (6). A negative interpretation should not delay the use of these procedures without subjecting the patient to any significant additional hazard. The greatest benefit to the patient would be gained by using brain scanning as the earliest special procedure. In approximately 2 out of 3 patients the more hazardous diagnostic procedures could be limited in number. Therefore, it is felt that brain scanning will be most valuable when narrow criteria are used for examination. Such criteria should eliminate false positives although a fairly large proportion of false negatives should be tolerated.

In this series there is no definite pattern of difference between the histology of those tumors detected and those missed by brain scanning (Table II). We can draw no conclusions about reliability of detection related to the histology of the tumors.

SUMMARY

A review of brain scans at the University of Colorado Medical Center showed 30 patients with proved space occupying, intracranial lesions. The correct diagnosis was made in 21 using narrow criteria. This leads the authors to conclude that the value of the examination lies in its use as the earliest special diagnostic procedure so that more hazardous procedures will be avoided.

ACKNOWLEDGEMENT

The authors wish to thank Drs. John R. Thornbury and Bruce A. Ward for their valuable assistance reviewing the brain scans for this study.

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