

Abnormal Radionuclide Cerebral Angiograms and Scans Due to Seizures¹

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The effect of recent seizures on the brain scan was determined in a retrospective study of patients who had had seizures. All patients who underwent brain scanning within eight days of seizures and who did not have a specific intracranial lesion were included. The ^{99m}Tc-pertechnetate cerebral angiogram and/or delayed scan was abnormal in 73% of 22 patients. The data suggest that if seizures occur within six days of the brain imaging, the image is likely to be abnormal.

INDEX TERMS: Brain, radionuclide studies • Epilepsy

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BRAIN SCAN abnormalities in epilepsy have been infrequently reported. "Faintly positive" scans were noted in 6 patients in status epilepticus (1). Another report described an abnormal brain scan which reverted to normal in an infant with focal seizures (2). Four additional cases in children (3) and increased perfusion to the affected hemisphere in two adults (4) were recently reported.

We encountered a patient with focal seizures caused by a lesion which was itself undetectable at the time of the original abnormal radionuclide cerebral angiogram and scan. A normal study after the seizures were controlled was followed 3 months later by a third scan which revealed a focal lesion that was subsequently confirmed by contrast angiography. The patient acted as her own control to show that seizures alone were the cause of the initial abnormal flow study and scan. This stimulated us to review the brain scans and medical records of all patients seen at our institution during the past two years who had had seizures.

CASE REPORT

A 68-year-old black woman with no prior history of neurologic disease experienced a classic Jacksonian seizure characterized by twitching movements of the left hand, marching up the left upper extremity to the shoulder. An electroencephalogram the same day was abnormal in the right temporal region. She was treated with anticonvulsants and experienced only occasional seizures until three months later when seizures began to occur at close intervals. On the day of the study they were almost continuous. Pertechnetate brain scanning, during which seizures occurred, revealed increased activity in the right cortex on both the radionuclide angiogram and delayed images (Figs. 1 and 2). The seizures were controlled, and repeat pertechnetate angiography and scanning 12 days later were normal (Figs. 3 and 4).

Three months later a third pertechnetate angiogram was normal,

but the scan revealed a focal area of increased activity high in the right parietal region (Figs. 5 and 6). Cerebral angiography demonstrated a vascular mass 2.5 cm in diameter in the same location (Fig. 7). The mass, resected a year later at another hospital, was reported to be a meningioma.

MATERIAL AND METHOD

All records coded as seizures over the past two years were reviewed, and all patients who underwent brain scanning within eight days of the seizures were included in this study. Twenty-two patients, ranging in age from 5 months to 70 years, with seizures not due to proven intracranial lesions, were found. All studies were performed using ^{99m}Tc-pertechnetate. Following administration of oral perchlorate and the intravenous injection of a bolus of 25 mCi of ^{99m}Tc-pertechnetate (appropriately reduced for children), four-second arterial and venous phase radionuclide angiographic images were obtained using an Anger camera with a parallel-hole collimator. Three hours later anterior, posterior, vertex and both lateral images were obtained using a dual probe 5-inch (12.7 cm) rectilinear scanner.

RESULTS

The flow study was abnormal in 15 of 22 cases and the delayed scan was abnormal in 9 of 22 cases. One or the other was abnormal in 16 of 22 cases. The flow study was abnormal in 15 of these 16 cases. The entire study was normal in 6 of 22 cases (TABLE I).

The radionuclide angiographic abnormality consisted of relative increased activity of the affected hemisphere in the arterial and usually in the venous phase. The delayed scan abnormality was increased activity, often faint, over the affected hemisphere.

¹ From the Department of Radiology, Division of Nuclear Medicine, Martin Luther King, Jr. General Hospital, and the Charles R. Drew Postgraduate Medical School, Los Angeles County, Los Angeles, Calif. Accepted for publication in June 1975. An additional article related to this subject will be found on page 87.

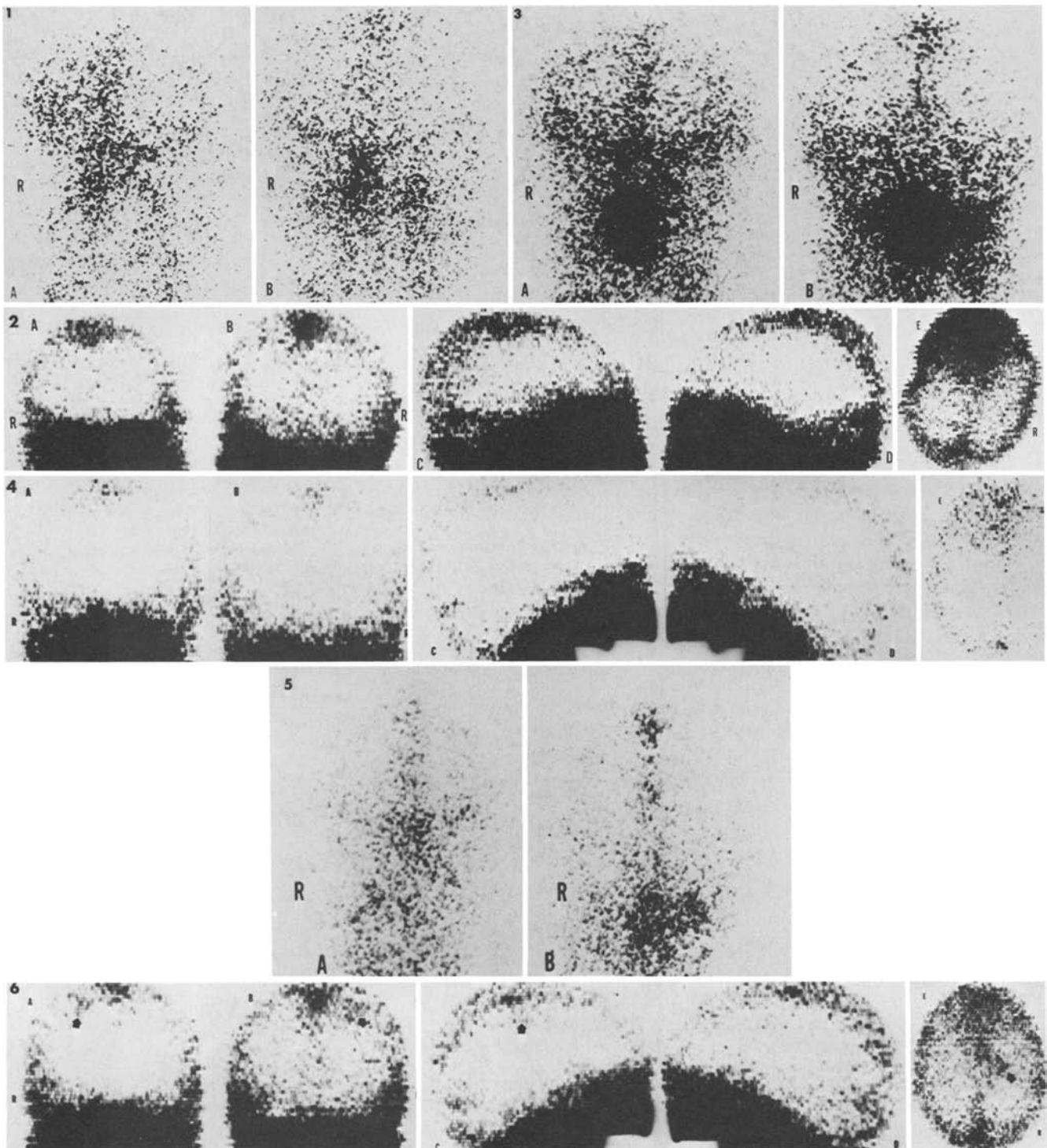


Fig. 1. Initial radionuclide cerebral angiogram during seizures shows increased activity in the right cerebral cortex during the arterial phase (A). The venous phase (B) is normal.

Fig. 2. Initial delayed images during seizures demonstrate increased activity in the right cerebral cortex on the anterior (A), posterior (B), and vertex (E) views.

Fig. 3. Twelve days later the radionuclide cerebral angiogram is normal, except for early appearance of nasopharyngeal activity.

Fig. 4. Normal delayed images twelve days later.

Fig. 5. Three months later the radionuclide cerebral angiogram remains normal.

Fig. 6. A focal area of increased activity (arrow) high in the right parietal region can be seen on the delayed images three months later on the anterior (A), posterior (B), right lateral (C) and vertex (E) views.

DISCUSSION

In the case presented, a lesion, evident on the elec-

troencephalogram but initially too small to be detected on the brain scan, caused abnormalities on the radionuclide cerebral angiogram and scan as a result of seizure

Table I: Correlation of Brain Scan Results and Clinical Data

Patient	Radionuclide Angiogram	Delayed Scan	Interval from Last Seizure	Description of Seizure	Follow-up Interval With No Neurologic Deficit
1	+	0	1 day	Single focal	16 mo.
2	+	0	<1 day	Multiple focal	13 mo.
3	0	+	6 days	Two generalized	No follow-up
4	+	0	<1 day	Single generalized	1 mo.
5	+	+	<1 day	Multiple generalized	6 mo.
6	+	+	<1 day	Single focal	10 mo.
7	+	+	<1 day	Single focal	3 mo.
8	+	+	2 days	Single generalized	3 mo. Died: aortic endocarditis and infarction of opposite hemisphere.
9	+	0	1 day	Poorly described	2 mo.
10	+	+	3 days	Multiple generalized	No follow-up
11	+	+	3 days	Multiple generalized	23 mo.
12	+	+	<1 day	Multiple focal	4 mo.
13	+	0	3 days	Two poorly described	6 mo.
14	+	0	1 day	Single generalized	3 mo. Died: ruptured spleen. Brain normal.
15	+	0	3 days	Status epilepticus	No follow-up
16*	+	+	0	Multiple focal	See text
17	0	0	8 days	Single generalized	20 mo.
18	0	0	7 days	Single generalized	No follow-up
19	0	0	1 day	Single generalized	22 mo.
20	0	0	4 days	Single generalized	17 mo.
21	0	0	2 days	Single generalized	30 mo.
22	0	0	2 days	Multiple generalized	1 mo.

* = The reported case. 0 = normal; + = abnormal.

activity it induced. These abnormalities resolved when the seizures ceased. When it reached a sufficient size, the lesion itself was delineated on a subsequent brain scan and contrast cerebral angiogram. None of the additional 21 cases presented in TABLE I showed a focal neurologic deficit at the time of study and all but 4 had additional follow-up interviews indicating no neurologic abnormality.

Our data suggest that if seizures occur within 6 days of brain scanning, the scan is likely to be abnormal. This is in contrast to the generally normal findings in patients with a history of a seizure disorder but no recent seizures. If the history of recent seizure activity is not known, the abnormal study can be easily misinterpreted. In 12 of the 16 abnormal studies, we suggested a variety of possible etiologies other than seizures.

The radionuclide angiographic finding of relative increase in perfusion to metabolically active cortex correlates with studies noting marked increases in brain-blood flow and oxygen consumption in animals with induced seizures (5). The cause for the widespread cortical abnormality on delayed brain scan images remains uncertain but may be related to the increased metabolic demand of the actively discharging cortex which cannot be met by the increased blood flow.

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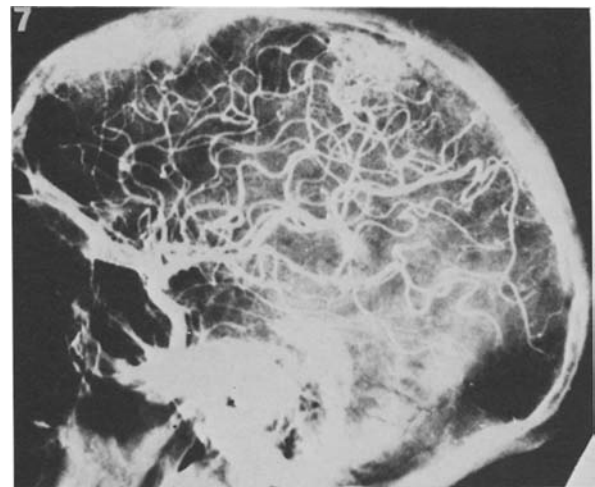


Fig. 7. A lateral view from a right common carotid artery injection shows a 2.5 cm diameter vascular mass high in the right parietal region.

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