

THE APPEARANCE OF PERIPHERAL POSTSURGICAL ACTIVITY ON CEREBRAL DYNAMIC STUDIES

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Peripheral tracer activity seen on cerebral dynamic studies obtained following brain surgery has been evaluated. Abnormal peripheral activity was seen in the surgical site in the venous phase of studies performed within 6 months of surgery. Persistence of abnormal activity beyond 6 months on repeated examinations was not observed in this series. Identification of abnormal peripheral activity more than 6 months postoperatively suggests skull or scalp infection or peripheral intracranial abnormality.

Abnormal activity may be identified on ^{99m}Tc -pertechnetate brain scans in scalp and skull defects for months or years following surgery or trauma (1,2). Because of this overlying peripheral activity, evaluation of intracranial lesions following surgery may be difficult (1). Rapid sequence scintiphotography of the cerebral circulation has been found to be of value in the postoperative evaluation of patients with brain tumor at this institution (3). Little is known of the appearance of peripheral extracerebral postsurgical activity recorded by this technique. The present study was undertaken to define the appearance of this postsurgical activity on cerebral dynamic studies.

METHODS

Thirty-three patients with malignant intracerebral gliomas were followed by repeated brain scanning at 2-month intervals for periods up to 44 months. One hundred six studies in 29 patients following osteoplastic craniotomy for this neoplasm were available for evaluation. Four of the 33 patients did not have surgery. Studies were obtained after injecting 20–30 mCi of ^{99m}Tc -pertechnetate (1–2 ml) into an antecubital vein. Patients were studied in anterior, posterior, or vertex projection, whichever allowed best visualization of the underlying neoplasm. Scintiphoto-

graphs (35 mm) were recorded at 2- or 3-sec intervals for 30 sec from the oscilloscope display of a scintillation camera (Searle Pho/Gamma HP). Peripheral activity, when present, was characterized initially by time of appearance following pertechnetate injection and visually quantified by comparison with the opposite peripheral area. Each successive study was evaluated for a change in the appearance of peripheral activity. Rectilinear brain scans were obtained 30–60 min following each cerebral dynamic study. The rectilinear studies were evaluated for abnormal peripheral activity for comparison with findings on the dynamic studies.

RESULTS

Fifteen of 29 patients were followed for 12–44 months. In this group abnormal peripheral activity corresponding to the surgical site was present on all rectilinear studies in 14 of 15 patients. The remaining patient had essentially normal peripheral activity 6 months after left frontal craniotomy. This patient underwent surgery again for tumor recurrence 14 months after initial surgery. Following the second operation abnormal peripheral activity was visualized at 2 and 4 months. All rectilinear scans performed on the 14 of 29 patients followed for less than 12 months had abnormal peripheral activity corresponding to the operative site.

Findings on cerebral dynamic studies are presented in Tables 1 and 2.

The appearance of abnormal peripheral activity on cerebral dynamic study following craniotomy is

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TABLE 1. FINDINGS IN OPERATIVE SITE ON 30-SEC CEREBRAL DYNAMIC STUDIES

Time after surgery of first cerebral dynamic study (months)	No. of patients	Number with significant peripheral activity	Vascular phase
>12	4*	0	—
6-12	5	0	—
3-4	5	2	venous
0-2	15†	10	venous

* One patient had repeat surgery for recurrent tumor. Abnormal peripheral activity present at 2 but not 4 months postoperatively.

† One patient had necrotic bone flap removed 4 months after initial surgery. This patient underwent a second procedure for removal of recurrent tumor 6 months after initial surgery. Peripheral activity was essentially normal 4 months after this second procedure.

TABLE 2. TIME TO DISAPPEARANCE OF ABNORMAL POSTOPERATIVE PERIPHERAL ACTIVITY FROM 30-SEC DYNAMIC STUDIES

Time after surgery to disappearance of abnormal peripheral activity (months)	No. of patients
>6	0
4-6	10
followed <6	2*

* Died.

demonstrated in Fig. 1. Sequential cerebral dynamic studies done at 2, 4, and 6 months following left frontal craniotomy for astroblastoma in one patient are shown in Fig. 2.

DISCUSSION

Dynamic studies of the cerebral circulation have been shown to be of significant value in the detection and definition of intracranial disease (4-8). Introduction of a ^{99m}Tc-pertechnetate bolus into an antecubital vein results in visualization of external as well as internal carotid arterial distributions. This creates no interpretive problems in the usual screen-

ing studies performed in patients without surgery. With the demonstration that this technique is useful in the evaluation of intracranial disease postoperatively (3), correct interpretation of radioactivity appearing in the surgical site becomes important. A normal 2-3-sec camera scintiphograph sequence of brain perfusion following intravenous injection of ^{99m}Tc-pertechnetate allows definition of an arterial phase during which the carotid arteries, middle cerebral arteries, and anterior cerebral arteries are seen. Following the arterial phase there is diffuse increase in hemispheric activity followed promptly by definition of the sagittal sinus, the posterior venous sinuses, and jugular venous activity. Well-defined radioactivity then clears from the cerebral circulation followed by recirculation and eventual distribution as defined by static brain imaging. In this study radioactivity in peripheral surgical sites was identified in the venous but not arterial phase as defined by cerebral dynamic study. In all studies performed longer than 6 months after surgery abnormal activity in the periphery was not significant during the initial 30 sec of recording. This suggests that serial images recorded within 30 sec of injection in cerebral dynamic studies do not include abnormal peripheral activity secondary to surgery in patients studied more than 6 months postoperatively. Later accumulation generally does occur, however, resulting in abnormal static brain scans as were seen in this study.

Unilateral increased peripheral radioactivity during the arterial phase of a cerebral dynamic study may be seen in malignant neoplasms, meningiomas, and arteriovenous malformations (9). Evaluation of rectilinear brain scans for residual or recurrent neoplasia is particularly difficult in the early postoperative period when peripheral postsurgical radioactivity is maximal. The finding that the skull and scalp peripheral postoperative radioactivity does not appear in the arterial phase of cerebral dynamic studies may be an important aid in the evaluation of these patients. Peripheral brain lesions which accumulate tracer after the arterial phase during a 30-sec cerebral dynamic study probably cannot be differentiated from postoperative radioactivity by this technique. The

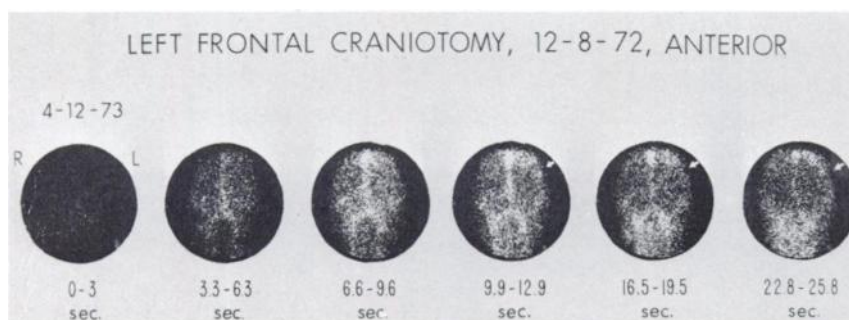


FIG. 1. Cerebral dynamic study 4 months following left frontal craniotomy. Increased left convexity activity in venous phase is indicated by arrows.

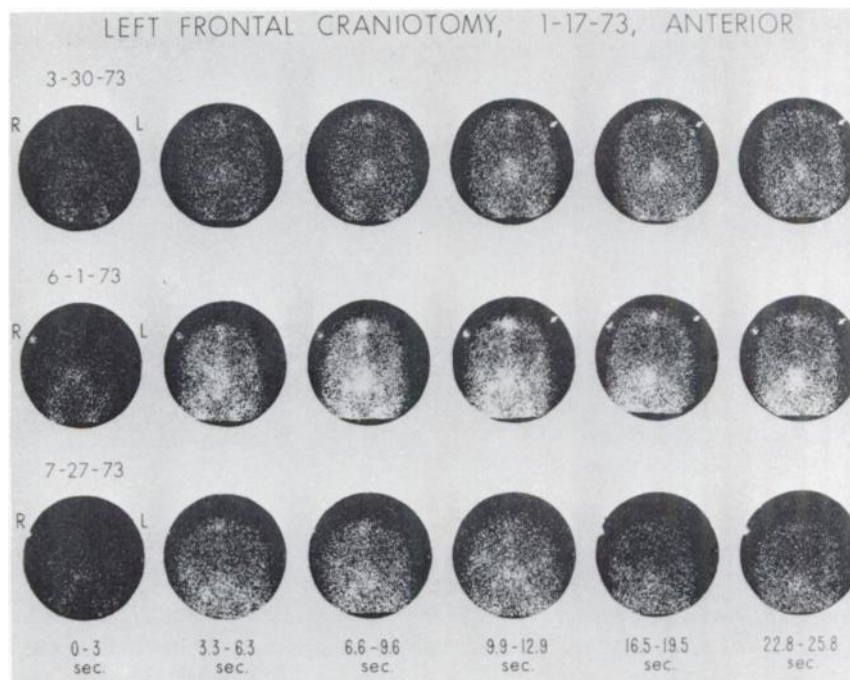


FIG. 2. Sequential cerebral dynamic studies following osteoplastic left frontal craniotomy. On 3-30-73 there is increased left convexity activity seen between 9.9 and 25.8 sec. On 6-1-73 this increased left convexity activity became more evident. On 7-23-73, 6 months following surgery, convexity activity is normal. There is decreased left hemispheric activity throughout related to resection and/or residual astroblastoma in left frontal lobe.

appearance of abnormal peripheral activity in the arterial phase postoperatively on a cerebral dynamic study in a patient with intracranial neoplasm suggests residual or recurrent disease.

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