RESULTS OF RADIOACTIVE ISOTOPE ENCEPHALOGRAPHY IN PATIENTS WITH VERIFIED INTRACRANIAL TUMORS
LOYAL DAVIS, M.D., AND THOMAS CRAIGMILE, M.D.
Department of Surgery, Northwestern University Medical School, Chicago, Illinois
(Received for publication December 14, 1953)

Since 1949, we have utilized radioactive isotope encephalography in the majority of patients we have observed who were suspected of having an intracranial tumor. The scanning surveys were made following the administration of radioactive di-iodo-fluorescein, radioactive sodium iodide, or radioactive human serum albumin. An earlier report of the results of isotope encephalography concerned itself with findings in normal patients and those with verified intracranial tumors, suspected intracranial tumors, craniocerebral injuries, inflammatory lesions, and various vascular abnormalities. The present study is confined to the results of the isotope study in patients with intracranial tumors verified at operation, or at the time of postmortem examination, by means of radioactive di-iodo-fluorescein and sodium iodide.

A total of 1251 patients have had isotope encephalographic studies. Among this number of tracings, 200 have been obtained upon patients in whom a primary, or metastatic, intracranial tumor has been verified microscopically. In this group, 193 tumors were verified at operation and 7 at autopsy.

Of the 200 patients studied, 159 underwent isotope encephalography following administration of radioactive di-iodo-fluorescein and 41 after the injection of the radioactive sodium iodide. With an insignificant number of exceptions, all of the individuals studied were adults and no attempt was made to evaluate the results upon the basis of the age of the patient. There has been no evidence that the sex of the individual undergoing testing is of importance. No attempt was made to compare the results of the examination in persons with a metastatic tumor from any particular primary site with those with neoplastic nodules from any other initial location. As might be expected, the predominant metastatic tumor found was a bronchogenic carcinoma.

Techniques employed in radioactive isotope encephalography have been described in detail elsewhere. Following intravenous administration of the radioactive substance, determinations of the degree of emanation of radioactivity are made at thirteen specific, diametrically opposite points on each side of the head. In addition to these twenty-six areas scanned, six midline readings are made.
RESULTS OF ISOPOE ENCEPHALOGRAPHY

Initially the end-window Geiger-Mueller tube with a suitable counting device and a graphic recorder of counts per minute were utilized. During recent months we have employed the more nearly accurate scintillation counter. No effort to separate the results using the two techniques has been made in this study.

Previous studies of the use of radioisotopes in the localization of neoplasms within the cranium have shown that tumors of certain histopathological nature as well as those in certain specific sites do not assimilate radioisotopic substances to a more than minimal degree. No tumor in this category was excluded from the study.

A critical analysis of the results of examination in patients suffering from primary neoplasms was not difficult after certain criteria concerning classification were established. Evaluation of our findings produced the following groupings: (1) accurate localization evidenced by an abnormally high focal concentration of the radioactive substances; (2) a somewhat more diffuse concentration of activity on one side of the head without evidence of any focal increase; (3) a generalized increase in radioactivity bilaterally, often involving both the supra- and infratentorial regions; (4) tracings displaying entirely normal concentrations in all areas; and (5) tracings revealing a focal increase in radioactivity at a site not overlying the later verified tumor.

Evaluation of the results in patients with metastatic intracranial tumors was not such a simple matter. In patients with a suspected, relatively large, symptom-producing nodule, there was the possibility that other clinically silent lesions existed which would influence the tracing. Even in those few cases that came to autopsy not long after examination, the presence of multiple metastases of widely varying size and situation made analysis of the results of the radioactive isotope encephalogram difficult.

The interpretation of a focal increase in radioactivity is simple and apparent. When comparable areas on the two sides of the head display such an elevation, one may assume that the lesion is located near the midline. For example, a bilateral increase in amplitude of radioactivity on the tracing in the anterior temporal area is interpreted as being indicative of the presence of an organic lesion in the region of the hypophysis or the rostral portion of the brain stem.

It has been postulated that the degree of up-take of a radioactive substance by an intracranial tumor depends upon certain interrelated factors, specifically the degree of vascularization, the degree of malignancy, and an increase in capillary permeability in the particular tumor encountered.

The average amount of di-iodo-fluorescein administered was 1.1 millicuries while that for sodium iodide was 300 microcuries. In no instance was any untoward reaction to the injected isotopic preparation experienced.

RESULTS OF STUDIES AFTER ADMINISTRATION OF RADIOACTIVE DI-IOIDO-FLUORESCIN

Of the 159 patients who were studied following the administration of radioactive di-iodo-fluorescein, a primary intracranial tumor was verified in