EVALUATION OF NaI\textsuperscript{131} BRAIN-TUMOR LOCALIZATION

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Despite the many reports on localization of brain tumors using radioiodinated diiodofluorescein,\textsuperscript{2,8,11,14} radioiodinated human serum albumin (RISA)\textsuperscript{6,7,9,12,13} and NaI\textsuperscript{131}, an adequate evaluation of this technique compared to the nonradioisotopic techniques of localization is not available.

To determine the efficacy of NaI\textsuperscript{131} in the localization of brain tumors\textsuperscript{4,10} and to compare its reliability in this respect to other diagnostic tests (electroencephalography, angiography, pneumoencephalography and ventriculography), 111 patients with clinical evidence of an intracranial lesion were studied. In all of these localization by the NaI\textsuperscript{131} test was done.

Only brain tumors verified by operation or necropsy were used to evaluate the method. The location of each brain tumor in the cranial cavity was compared with the point on the skull at which the maximum radioactivity was obtained, in order to ascertain the true localizing ability of the procedure. Space-occupying lesions discovered by angiography, pneumoencephalography, ventriculography and clinical findings, not histologically verified, were not considered for purposes of evaluating the radioisotopic test. Only by using this approach can a definitive answer to the value of a procedure be achieved. It is not intended that this study review the general problem of radioisotopic localization of intracranial lesions, nor is it maintained that NaI\textsuperscript{131} used with the detecting system described is the best available radioisotopic means of localization of brain tumors. This study can serve, however, as a model to be followed for the evaluation of new methods of radioisotopic localization.

Data on the results of the various diagnostic procedures mentioned, performed on the same group of patients, will be presented and compared with the findings of the radioisotopic test, and an attempt will be made to estimate the relative value of the latter in the diagnosis of brain tumors.

METHOD

Preparation of the patient with Lugol's solution, 10 drops 3 times daily for 3 days preceding the administration of the dose, was necessary, and the study was carried out with the subject in the reclining position 1 hour following the dose of radioiodide. After administering 800 \( \mu \)c of NaI\textsuperscript{131} by mouth, activity was measured with the probe flush on the skull at points depicted in Fig. 1.

Readings were repeated at points at which a differential was obtained between right and left side in order to confirm the differential. The results obtained at 1.5 hours were used. A 10 per cent difference or higher between corresponding loci was considered a significant difference indicating an abnormal concentration of activity, suggesting a break in the blood-brain barrier caused by a tumor or other lesion.\textsuperscript{1,10}

In some patients without tumor there is a predominance of activity when counting on the left C7 basal region. This left-sided increase, which was considered in evaluating the results, never exceeded 8 per cent of the opposite side, and may indicate increased vascularity of the left side of the brain.

A bismuth cathode Geiger tube, utilizing organic quenching of the thick glass-wall type was used (Model 10400 C.L.). The tube was placed inside of the cylindrical lead collimator, the wall of which was 7/16 in. thick. The flat end of the bismuth tube was recessed 1/4 in. from the end of the lead cylinder. The apparatus is shown in Fig. 2.

Isosensitivity curves for the tube are shown in Fig. 3. A source placed in the central axis of the probe 2 1/2 in. away from the surface of the probe showed a 73 per cent loss in sensitivity as compared to the same source placed 1 in. away from
the surface of the probe. This indicated that maximum sensitivity of the probe was confined to one side of the midline of the head, making lateralization possible.

The shielded probe was not well collimated, for too stringent a capacity for localization would mean missing a point of increased activity located in between the points of application of the probe, while too extensive vision of a probe would make localization difficult.

Studies with a phantom indicated that the probe showed the capacity to localize to a volume that approximated grossly the size of a cerebral lobe. This, of course, assumes that selective localization occurs to a sufficient degree in the brain tumor in actual practice, when counting over the skull in the living subject.\(^1\)\(^2\)

In the normal patient, corresponding locations on opposite sides of the head showed the same activity, with the exception of the C7 area referred to above.

For the purposes of this study, rigid criteria of localization of the lesion by the radioisotopic test were used. Localization was considered successful only when the points of maximum activity found on radioisotopic study were localized on the skull in a location corresponding to the segment of the skull overlying the cerebral lobe in which subsequent postmortem or operative examination demonstrated the lesion.

RESULTS

Of the 41 verified tumors, 78 per cent showed an abnormal radioisotopic study, but only 34 per cent showed reasonable compatibility of the radioisotopic findings with...