BRAIN SCANNING WITH MERCURY\textsuperscript{203} LABELED NEOHYDRIN*

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By means of an outpatient procedure, which carries no immediate risk to the patient, we have been able, during a one-year period which commenced in December 1960, to locate exactly the majority of surgical lesions seen in brain-tumor suspects on the Neurosurgical Service. What has been to us a revolutionary change in our routine diagnostic procedures has come about through photoscanning, utilizing \textsuperscript{203}Hg labeled Neohydrin. Of 92 patients who we now are certain were harboring brain tumors at the time of their first scan with mercury, the exact location of the tumor was demonstrated in 60. In other words, the precise position of two-thirds of the brain tumors scanned had been established before the not entirely innocuous procedures of arteriography and ventriculography were even considered.

Arteriography and ventriculography remain invaluable methods of diagnosis. In the majority of cases, however, the tumor is demonstrated only indirectly by blood-vessel or ventricular displacement. With a direct method of tumor visualization such as photoscanning, the bone flap almost invariably can be placed so that it centers directly over the tumor. The accurate placing of the bone flap is important, for we are absolutely certain that the less the surface of the normal brain is exposed while a tumor is being removed, the smaller is the chance of an untoward postoperative reaction.

Photoscanning is now the first procedure we employ in the management of brain-tumor suspects after the neurological examination and routine roentgen-ray studies have been completed. We have had great help from electroencephalography in the localization of brain tumors in the past; but we are seldom willing to turn down a bone flap on the basis of electroencephalographic findings alone. The time spent and the cost of these studies is comparable.

Since we have experienced no false-positive scans for tumor so far, surgery often is carried out on the basis of the scan alone. Arteriography is used frequently, however, following a positive scan to aid in the technical approach to the tumor. In operations involving meningiomas in particular, knowledge of the surrounding main blood vessels and of the vascularity of the tumor is essential. The surgeon is much more willing to chance the complications that are entailed in arteriography and ventriculography when he is certain that a tumor actually is present.

Our renewed interest in scanning\textsuperscript{2} has come about through certain refinements in instrumentation and the use of new radioisotope labeled compounds. These refinements include focusing collimation, larger scintillation crystals, and photorecording\textsuperscript{3} and the insertion of pulse-height analyzers. The new isotope being used currently is \textsuperscript{203}Hg labeled Neohydrin (chlormerodrin), introduced by Blau and Bender in 1959.\textsuperscript{1} Twenty-four hours prior to the time of the scan, 1 cc. of Mercuhydrin is administered intramuscularly. This blocking dose is important as it has been shown\textsuperscript{1} to reduce the kidney dosimetry threefold in most patients. The labeled Neohydrin is given intravenously 4 to 6 hours before the actual scan is carried out.

A photoscanning device\textsuperscript{4} with a 19-hole collimator is used; scanning speed is 16


cm./min. with 0.5 cm. spacing; the dot factor (impulses/dot) is 8; the background cutoff varies with the background count; the time constant is $\frac{1}{4}$ of a sec. The photorecording system is adjusted after a preliminary scan, moving the probe by hand, to estimate the highest and lowest activity over the entire head. The pulse-height analyzer is set to accept gamma energies of 0.24 mev. to 0.32 mev. Absolute fixation to the head is essential since a single scan takes 30 to 40 min., and a minimum of two scans is required. Landmarks used for the lateral scan are the external auditory meatus, the tip of the mastoid process, a point along the vertex of the skull, and the glabella. In the anteroposterior scan, in which the crystal and roentgen-ray film are anterior, the pupils, the vertex and the tips of the mastoid processes serve as landmarks. In the posteroanterior scan, in which the crystal and roentgen-ray film are posterior, the mastoid processes, the occipital protuberance, the roots of the zygomas and the vertex are employed. These landmarks are represented carefully on the dot scan. After the scan has been completed, the landmarks are rechecked. If localization is evident on the dot scan, a notation is made of the activity over this area. The photoscans then are developed and superimposed on the dot scan, and the original landmarks are transferred to the photoscan. The routine films of the skull then are used to draw the outline of the skull. Since the focusing point of the collimator in water is $2\frac{1}{2}$ in., a lateral scan, to be of optimum value, must be carried out on the side suspected of harboring the lesion. An anteroposterior scan is done routinely unless there is posterior localization on the lateral dot scan, in which case a posteroanterior scan is carried out.

CASE HISTORIES

Case 1. A 73-year-old female had a 1-year history of left-sided Jacksonian seizures progressing to grand mal. A left-sided paresis developed 1 day prior to admission. Clinically a right-sided tumor was suspected. Arteriography, however, demonstrated a left to right shift of the anterior cerebral artery. The scan was sharply localizing for a left-sided lesion (Fig. 1). A left-sided glioblastoma multiforme was demonstrated at operation.

Case 2. A 51-year-old, highly skilled professional man was admitted with a tentative diagnosis of reserpine poisoning because of apathy and confusion. The neurological findings were entirely negative. A scan taken 24 hours after the patient was first seen revealed evidence of a mid-line lesion extending deeply (Fig. 2). The tumor was deemed inoperable but a biopsy was performed revealing a glioblastoma of the corpus callosum and septal area. Death occurred 24 hours postoperatively.

Case 3. A 50-year-old female had a history of seizures for 6 years, and a change in personality for 2 years. Visual loss had been noted for the past 3 months. The neurological examination revealed a left-sided paresis but no demonstrable anosmia. The scan suggested a bilateral olfactory groove meningioma (Fig. 3). The meningioma was re-