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Intracranial Surgery

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INTRACRANIAL SURGERY*

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DIAGNOSTIC METHODS

In the treatment of cerebral tumors there is still a great need for earlier diagnosis. It is surprising and disappointing to find a tumor that has grown into adjacent structures to such an extent that it cannot be completely removed and yet the demanding symptoms have lasted only a few weeks. One third of patients with a brain tumor have, as the initial symptom, spells which may be of mild or severe degree. Any patient who starts to have spells after the age of twenty-one years must be suspected of having a brain tumor unless some other abnormality can be clearly identified to account for the attacks.

After a careful history, physical and neurological examinations, X-rays of the skull are usually of interest. They should be taken so that the suspected side is shown stereoscopically and so that one anteroposterior view shows the pineal body. This structure is usually visible and can be measured for significant shift in the lateral view as well as in the anteroposterior.

When the electro-encephalogram fails to show an abnormal wave it can hardly help to locate the trouble, but a normal tracing does not in any way exclude the possibility of an area of pathologic change. When a normal tracing is found in the investigation of epilepsy it is possible to give metrazol intravenously during the tracing. This may bring on a typical spell or focal cortical discharges, and then there is a better chance that the electro-encephalogram will be of localizing value. This use of metrazol has not been standardized yet in cases of tumor.

Air studies can be carried out in two ways. For an encephalogram the air is introduced by spinal puncture, with the patient sitting. This does not always fill the ventricles completely, and, when looking for a tumor, a ventriculogram is more satisfactory, since the air is injected directly into the ventricle through a burr hole. The latter method is accompanied by less discomfort and less risk if intracranial pressure is increased. It must be remembered that a normal ventriculogram does not rule out a brain tumor. Thus it may be necessary to repeat the air study at intervals, depending on the clinical course.

When there is reason to expect an aneurysm or a vascular anomaly, a cerebral angiogram can be carried out by injecting the carotid artery in the neck with a radiopaque material and taking X-rays at the proper time. Thorotrast or diodrast is used, and one may puncture the artery under direct vision or by blind puncture. From two to five films are then exposed at intervals of about one second. A mechanical film changer has been developed that makes the exposure automatically as the cassettes are pulled to one side. Some types of tumor can be shown in this way better than by air studies.

Neurophysiological methods are gradually being adapted to aid in the neurological examination. Quantitative and graphic records allow a more exact evaluation of the function being tested and also an analysis that is not possible when the response is simply observed visually (figure 1).

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SURGICAL PROBLEMS

The risk of an operation on the brain is not great so that, except in cases of large tumor with irreversible changes in the brain stem, the chance of survival is quite good. A patient is less upset by the wide excision of a brain tumor with surrounding brain than he is by a partial removal. Postoperative hyperthermia, once the bugbear of neurosurgeons, is seldom seen any more. It is due to diffuse cerebral edema that develops when a high intracranial pressure is allowed to drop too far or too quickly. To avoid this, the ventricular pressure is allowed to fall by stages before the air study is carried out. The use of hypertonic sucrose before and after operation helps in addition to prevent cerebral edema.

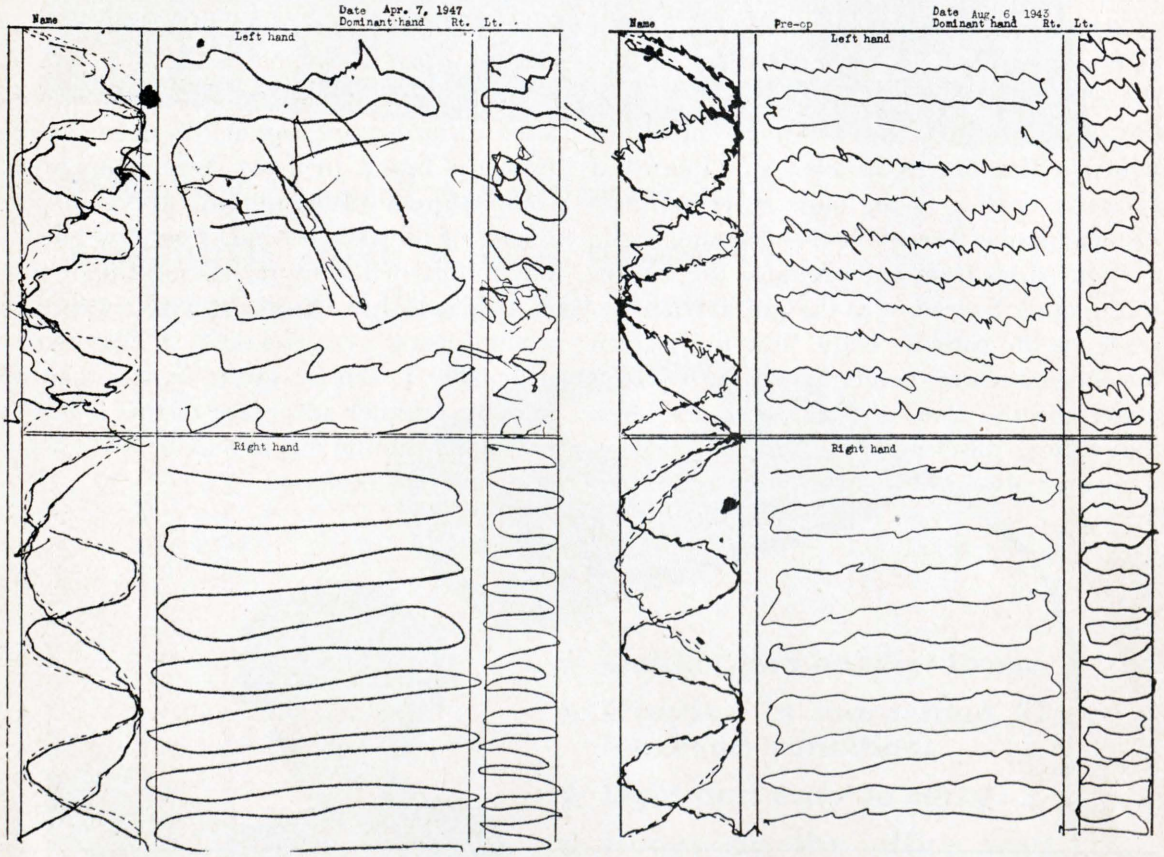

FIG. 1. The two wavy tracings above were made with a flexible pen, and serve to record motor control similar to that in the finger-to-nose test. The method* was described in detail recently. The tracing on the left shows much disability of the left hand, due to an old injury in the right cerebral hemisphere. The gross and irregular deviations from the intended line of movement are typical of a lesion affecting the precentral gyrus. The other tracing was made by a patient with a left cerebellar lesion. The characteristic effect is a tremor that is evident in all parts of the tracing. Even in very severe cases the general line of movement is surprisingly good, in contrast to the tracings made by patients with lesions in the cerebral hemisphere.

When the scalp has been infiltrated with novocaine the operation is almost painless, and light anesthesia with avertin or sodium pentothal, or both, is sufficient. In cases with

* Grant, W. T.: Graphic methods in the neurological examination. Wavy tracings to record motor control, Bull. Los Angeles Neurol. Soc., 12, 1947 (in press).

compression of the medullary centers an intratracheal tube is necessary for possible artificial respiration, and this calls for a deeper level of anesthesia. Often a good part of the operation can be carried out under local anesthetic and the patient does not ask to go to sleep until he becomes tired or until irritation of the dura causes too much discomfort.

Measures to stop bleeding vessels have been extended beyond the use of silver clips and the electrocautery. The latter is still applicable in most places and, when an important structure lies directly beneath, one can avoid excessive heating of the underlying brain by using a bipolar forceps. In this instrument the current passes from one prong of the forceps to the other instead of to the indifferent electrode via the patient's body. Vitamin K given for one or two days before operation improves materially the clotting time. It is not often that a large vessel is torn, since improved instruments allow the vessels to be cauterized under direct vision before being divided. Such instruments include self-retaining retractors with attached suction, irrigation and lights, insulated cautery tips and forceps so that they can be used at the bottom of a deep hole without being short-circuited at the side of the wound. Fibrin foam and the fabricated gelatin products are most useful to stop bleeding from veins that enter one of the large venous sinuses.

Deep X-ray treatment is usually of value after an infiltrating tumor has been removed from the brain. In many cases of apparently complete removal of a glioma there are small islands of cells left behind. The most effective way to deal with any remaining tumor tissue is to give X-ray treatment directly into the wound, using a contact tube. A dose of more than 6000 r. can be given in less than one minute. Another advantage of this is that the patient avoids the loss of hair that follows the postoperative radiation.