THE DANDY METHOD OF LOCALIZING BRAIN TUMORS BY THE ROENTGEN RAY

WITH REPORT OF A CASE

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The indispensability of roentgen-ray examinations in general medicine is well recognized. Few physicians realize, however, how much assistance the roentgen-ray picture of the skull and of the spine can afford the neurologist and the psychiatrist. Certain cases of congenital brain syphilis, of traumatic epilepsy, of pituitary disease, of cerebral arteriosclerosis, of cervical rib and of a few other conditions have, in our experience, been diagnosticated chiefly on the basis of the roentgen-ray findings.

Nothing is more disappointing, on the other hand, than the roentgen-ray findings in brain tumor. There are few cases of brain tumor in which the roentgen ray gives us any information other than that which we already possess from clinical findings. It is usually of no help in localization.

All of this is, perhaps, on the point of being radically changed by the principle of photographing the ventricles of the brain filled with air. This idea was suggested and put into practice by Walter E. Dandy of Baltimore, who showed that when ventricular fluid was removed and air injected, a roentgen-ray plate showed sharply the outlines of the ventricles. A tumor present in the brain is likely to encroach on the ventricle at some point or another and this distortion would clearly show in such a roentgen-ray photograph. The procedure, then, is to make a small trephine opening in the skull, insert a long needle into the ventricle, remove the cerebral fluid, inject air, photograph with the roentgen ray, and compare with similar photographs of normal ventricles.

The present opportunity is much too limited to present the entire theory of the interpretation of these plates. This has been done by Dandy in six or seven contributions, and the procedure will be exemplified by a case of my own.

I am quite aware that the following case is not a perfect illustration of the advantages of Dandy's method. While there is apparent correlation of the clinical diagnosis and roentgen-ray findings, it is a point of great regret that surgery did not confirm the diagnosis and effect the treatment. I think we should not be the least disheartened

by this for the reason that in all human probability there will long remain problems of treatment even after the diagnosis is indisputably made. The attempt at surgical removal in this case was made, and the fact that it was unsuccessful is not a reflection on the surgery, for such failure has long been a common surgical experience; nor, on the other

Fig. 1.—Stereoscopic illustration showing no abnormality except a shallow sella and evidences of tremendous intracranial pressure in the separation of the sutures.

hand, is it a reflection on the diagnosis, for there is little doubt, everything considered, about the correctness of this. On the whole, there is reason to believe that this method will be of tremendous value in the more accurate localization of brain tumors.

CASE REPORT

History.—F. S., Case 206, was a lad of 6 referred by Dr. J. F. Shelley of Elmdale, Kan. His family history was negative except for the following facts: A second cousin of the father was said to have been insane and to have had epilepsy. The father also had a sister subject to sick headaches. The father was of English descent, the mother of mixed ancestry. Both were fairly typical

Fig. 2.—Left side of the head. The ventricle has been filled with air. It is not encroached on at any point but is uniformly dilated to about three times the normal size.

rural folk, aged 44 and 42, respectively. There were three other children, aged 11, 4 years, and 6 months, all in good health.

The child was born at full term, normal delivery, was breast fed and began walking, talking and teething at the usual ages. He had the nail-biting habit, but there was no history of convulsions, enuresis, etc. He had always been

well, except for occasional attacks, when he would wake up with a headache, vomit and then feel all right. He had had several accidents, such as falling off of a hay wagon and being run over by a lumber wagon, but with no ill effects so far as known. Although he had not been to school, he had learned to count to 20 with a few mistakes. His social and temperamental reactions were normal.

Fig. 3.—An anterior-posterior view of the head after the injection of air. This picture was taken with the subject in a prone position.

Present Illness.—In November, 1919, he had had scarlet fever of moderate severity, followed by slight albuminuria. Headaches of marked severity, especially over the frontal regions, were noticed shortly afterward. Headaches had

been noticed for several years as mentioned in the foregoing, but they now became prominent and occurred every day, and were more severe at some times than at others. Vomiting nearly always occurred in association with them. It was not projectile and did not always relieve the headache. The urine was negative. He was given some salicylates and seemed to improve.

Nearly three months later he was again brought to the physician's office with the report that the headaches had increased in severity. For two weeks he had been holding his head tipped to the left, and he once complained of not seeing well. Although he had not fainted or fallen, he had difficulty in walking and the physician thought there was a tendency to veer to the left. He was untidy at the table and was restless and fidgety all the time. He had had no fever.

Physical Examination.—He was first seen by me on April 19, 1920. At that time I made the following notes: bilateral choked disks; pupillary reaction normal but left pupil irregular in outline; visual acuity not greatly diminished; head tipped to the left; slight left facial paresis; tongue and uvula deflected to the left; positive Macewen's sign; no speech defect; hypotonus of the fingers, especially of the left hand; reflexes generally normal; positive Romberg sign; bilateral Babinski and Schäfer's reflex; erection of penis when abdomen is scratched, and staggering gait. Special cerebellar tests were made following the schemes of Weisenburg, Tilney, and others.

The Bárány tests of past-pointing were used. With the right hand there was almost always a spontaneous deviation to the left of from 5 to 20 cm., usually about 10. This was true whether the horizontal or the vertical plane was used. With the left hand the deviation was not quite so constant nor quite so marked, but there was some deviation to the left apparent with both planes. Stimulation of the internal ear was not done.

Babinski's five tests of asynergia minor were nearly all positive. The leg was raised in two movements instead of one, the body was flexed before the leg in attempts to sit up (in fact, the legs were never flexed, but were raised stiffly with the buttocks as a pivot). Touching points with his toes was inadequately and jerkily done. Kneeling on a chair was not tried. He was unable to lean backward and failed to make proper coordination of the legs when it was attempted.

Andre-Thomas tests for dysmetria were made. The grasping of a glass of water, the supination of the palms and the awkward heel to knee placing were suggestive but not convincing. Babinski's adiadokokinesis tests were distinctive, the left arm being much worse than the right. The rebound phenomenon of Holmes was slightly present on both arms.

Trunkal asynergia was manifested in the saddle gait which showed cerebral walking rather than cerebellar. He could sit for a long time and had more difficulty with his eyes shut than with them open. In other words, he seemed to have a positive Romberg sign. Fournier's tests of gait were found inconclusive.

Laboratory Findings.—The blood and urine were normal. The spinal fluid pressure was greatly increased. The globulin test was positive; the Wassermann and colloidal gold tests were negative.

Roentgen-Ray Examination.—Stereoscopic roentgen-ray examination (before trephining) of both the right and left sides of the head showed marked evidence of intracranial pressure. The suture lines were wide open, especially in the region of the anterior fontanel. There was no evidence of a sella.

Visual Fields.—The visual fields were studied by Dr. C. L. Williams on April 9 and showed marked contraction, approximately equal on both sides, and in both instances averaging only about 15 degrees. They were fairly round.

Treatment and Course.—On April 22 the spinal fluid was secured. It was under great pressure and following the removal of a small amount the choked disk receded noticeably and the facial and eleventh nerve palsies largely disappeared. His gait was better than before.

On May 11 a small trephine opening was made at the vertex, the ventricle tapped by means of a lumbar puncture needle and 50 c.c. of cerebral fluid removed, the same amount of air being injected gradually as small quantities (10 c.c. at a time) of the fluid were removed. Roentgen-ray plates were made before the patient came out from under the anesthetic. There was a slight reaction of fever and vomiting, but this was not serious and disappeared after thirty-six hours. The patient was much better after this. Splashing of the cerebral fluid could be heard at a distance of several feet when his head was shaken.

Nystagmus was detected for the first time on May 14, although it had previously been looked for. When the eyes were directed to the right there was a definite nystagmus with a slow component to the left; when the eyes were directed to the left there was a nystagmus with a slow component directed to the right.

As the roentgenograms show, the diagnosis of cerebellar tumor was adequately justified. In the first place, there was an obvious hydrocephalus. This is shown by the lateral views. The anterior-posterior view taken with the child in the prone position, shows that the two lateral ventricles were dilated symmetrically and equally. Fluid removed from the left ventricle must drain through the third ventricle into the right ventricle, into which the needle was inserted, and this illustration shows that the drainage was apparently incomplete. That it was a technical fault appears probable from the fact that the ventricle did receive enough air to outline it distinctly, and the haziness is caused by the pool of fluid in the anterior horn of the ventricle. The approximate equality in dilatation of the two ventricles and the fact that they are not displaced from the midline shows, according to Dandy, that the obstruction (neoplasm) is cerebellar, between the aqueduct (or foramen of Monro) and the foramen of Magendie.¹

I am indebted to Dr. Samuel T. Orton for the suggestion that this statement of anatomico-pathologic principle is scarcely broad enough. Any obliterative focal pressure exerted on the aqueduct of Sylvius behind the anterior end would cause the same result (equilateral hydrocephalus). That this need not be restricted to cerebellar tumors must be obvious from a consideration of the outlines of this region. Tumors springing from the corpora quadrigemina, for example, or from almost any point in the floor of the fourth ventricle, could and likely would

1. Dandy says: "Except in rare instances only tumors in the brain stem or cerebellum can produce a symmetrical bilateral internal hydrocephalus," Surg., Gynec. & Obst., April, 1920, p. 338.

produce the same picture, and of course, an inflammatory process with blocking of the aqueduct would produce the same effect, as Dandy² himself has illustrated.

We need, then, to look well to the clinical (neurologic) indexes, and if these fail, it is doubtful that we are justified in positively concluding that the lesion is a cerebellar one.

Further Course.—In this particular case the neurologic indications seemed well confirmed by the ventriculographic plates (or vice versa). Operation was attempted a few days later. A bone flap was reflected in the occipital region, and neither inspection nor palpation revealed a tumor. The patient reacted poorly to the anesthetic. Constant blood pressure readings were made, and after about thirty minutes, the rising pulse and falling pressure made it seem wise to discontinue the search, and the wound was closed.

The patient made a poor recovery from the operation and was for many days stupid and at times delirious. He had a few convulsions during the second week. He gradually regained strength and was removed from the hospital. He has not been seen since.

2. Dandy: The Diagnosis and Treatment of Hydrocephalus Resulting from Stricture of the Aqueduct of Sylvius, *Surg., Gynec. & Obst.*, October, 1920.