PNEUMOENCEPHALOGRAPHY IN CHROMOPHOBE ADENOMAS OF THE HYPOPHYSIS

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The value of pneumoencephalography is generally conceded to lie in the assistance it gives the surgeon in planning his approach and in making possible a more nearly accurate prognosis. This diagnostic procedure, however, is seldom performed routinely in cases of pituitary adenomas. Once the diagnosis of an adenoma is established by the presence of an enlarged sella and visual and endocrine symptoms, little attention is given to determining the exact position and extension of the neoplasm, despite the fact that in some cases there is a marked discrepancy between the clinical signs and the true size and extension of the adenoma.

The size to which a neglected chromophobe adenoma may grow is illustrated by the case reported by White and Warren. This man, who had lived in China, had noticed increasing loss of temporal vision and endocrine changes over a period of 10 years, but still maintained 20/40 vision on the nasal half of his left eye. He entered the Naval hospital in Chelsea following the onset of headaches, personality change, and seizures. Death followed an attempt to remove his huge chromophobe adenoma, which was found at post mortem to weigh 150 gm. and to extend from the crista galli to the pons, and upward nearly to the corpus callosum.

Large series of operations for pituitary adenomas clearly show that the low operative mortality rate of intrasellar tumors increases considerably if the adenoma extends beyond its original boundaries. Thus, the mortality rate in Jefferson’s series increased from 2 per cent to 33 per cent, and in the 300 operations of Olivecrona from 6.4 per cent to 35 per cent (Bakay). It was pointed out in a previous paper that even slight extension above the sella impairs the surgical results. When the adenoma protruded largely into the 3rd ventricle, the surgical mortality rate reached a peak of 74 per cent. But fatalities were more frequent even in patients with lesser hypothalamic involvement than in those without it, and the late results of the operation were not favorable. Patients with chromophobe adenomas are often treated by endocrinologists and internists and when the choice of surgery or X-ray treatment comes up for discussion, the surgeon usually has to give an estimate of the surgical hazard involved. Here, knowledge of the extent of the adenoma helps considerably. Sometimes there is no way to determine the size of the neoplasm except by encephalography.
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TECHNIQUE

Pneumoencephalography is performed under local anesthesia through a lumbar puncture, with the patient in a sitting position. Mere visualization of the basal cisterns alone without seeing the outlines of the ventricular system is not sufficient. It is essential to visualize the ventricles, especially the 3rd, to determine the relationship between an extrasellar extension of the adenoma and the anterior portion of the 3rd ventricle. On the other hand, air in the subarachnoid spaces of the convexity of the brain should be avoided; it does not serve any useful purpose, only increasing the patient's discomfort and sometimes interfering with the interpretation of the picture by overshadowing the sellar and suprasellar structures in the lateral projection.

To obtain satisfactory filling with as little air as possible, the patient should sit fairly erect, with his head flexed forward to 45°. The head rests against the obliquely placed X-ray head unit. This amount of flexion corresponds to a 30° inclination of the orbitomeatal line which—according to Robertson13—favors exclusive filling of the ventricles. Five cc. of air are usually injected through the lumbar needle before withdrawing any of the CSF, except for a few drops to verify the position of the needle. Lindgren19 pointed out that satisfactory filling of the ventricular system is more surely obtained when air is injected prior to the evacuation of fluid, although this opinion is not shared by Robertson.14 Following the initial injection of air, CSF is exchanged with air slowly and in amounts of 5 cc. at a time. Films taken during this procedure reveal the location of air in the intracranial cavity; often the patient himself can give valuable information in this matter. Absence of pain or headache means usually that the air is passing into the ventricles. Complaints of headache and nausea indicate that the ventricular system and great cistern are filled and the surplus air is rising to the convexity of the brain or that the air is entering the subarachnoid spaces instead of the ventricles. The amount needed to outline the ventricular system varies with the capacity of these structures. As an average, 20 cc. are sufficient.

When the ventricles are filled, the head is flexed slightly backwards to obtain a maximal filling of the basal subarachnoid spaces. In this position of the head the subsequently injected air (usually 10 cc.) fills the chiasmatic and interpeduncular cisterns through the cisternae pontis. Actually, the effect of this extension of the head is twofold: (1) it creates a good position to fill the perisellar spaces with a small amount of air; (2) according to Robertson13 it also serves to pass air from the dorsal part of the cisterna magna into its ventral part dorsal to the medulla, whence it rises into the ventricles.

After the air filling is completed, the lumbar needle is removed and the patient is placed upon the X-ray table in a face-up position and without turning his head around. The sitting patient simply reclines and is slipped over to the table. To facilitate this step, one uses for the air filling a dental chair, with removable back, which can be elevated to the level of the table. In our experience, a considerable part of the air trapped in the basal cisterns can escape toward the convexity if the patient is turned around. This is also the reason for taking the crucial films immediately after the patient has been placed in the face-up position. This series of films, of course, is completed by taking the lateral and P-A views, after the patient has been turned on his abdomen; however the most important ones are taken first. These include the A-P and brow-up lateral view, preferably stereoscopic ones. These pictures include the usual views with brow up (the orbitomeatal line is