Ventriculo-Caval Shunt in the Management of Posterior Fossa Tumors*

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Puncture of the lateral ventricle is a well-recognized and commonly practiced method of reducing increased intracranial pressure during operation for posterior fossa tumors. It is mostly performed just before opening the dura, and it is repeated, if necessary, during or after the operation. This procedure is not, however, adequate for all patients with posterior fossa tumors who have increased intracranial pressure. Deterioration may occur spontaneously before preoperative studies and preparations are complete, or it may be precipitated by the alteration in intracranial dynamics induced by the preoperative air studies. It may be associated with the induction or faulty maintenance of general anesthesia used for the preoperative air study or with the induction of anesthesia for the definitive procedure itself. Milder degrees of this deterioration may force the surgeon to intervene before water and electrolyte loss, depleted by poor intake and vomiting, is corrected; more severe degrees may result in permanent brain damage before normal pressure can be restored.

There are also postoperative problems. Despite apparently satisfactory surgical treatment of the tumor, all patients are not able to handle their intracranial pressure adequately. This may be due to incomplete removal of the tumor, to obstructive swelling in surrounding brain, or to partial obstruction of the cerebrospinal fluid absorptive pathways by blood. In such instances, ventricular puncture may be necessary. Because of the late development of clinical signs, obscured sometimes by the patient's postanesthetic drowsiness, it may not be performed until the conscious level has deteriorated seriously or even irreversibly.

To prevent these dangers of preoperative and postoperative increase in intracranial pressure, satisfactory continuous ventricular drainage of the cerebrospinal fluid to an outside reservoir has been practiced under a variety of techniques.2-8 Dott1 has used external ventricular drainage, for an anticipated posterior fossa approach, since 1945. He used an antibiotic cream around the inserted ventricular tube to prevent infections. He wrote: "These measures have served us very well over the years." We have also used this method for some patients and have no question about its advantages. At present, we have almost given it up because of a number of disadvantages. It may introduce infection into the lateral ventricles and for this reason can rarely be used for more than 1 week. It requires constant checking and care to make sure it is functioning. The drainage bottle and the resulting pressure may be maintained at a dangerous level by inexperienced nursing personnel. It ties the patient to his bed, which is particularly difficult in children. Lastly, it makes the patient's transportation to x-ray or operating room awkward; the repeated disconnections of the tubing become an additional source of infection.

Our final dissatisfaction came in the management of a 9-year-old girl with a posterior fossa astrocytoma; the immediate postoperative intracranial pressure remained elevated despite adequate unblocking of her aqueduct, as demonstrated at operation and by her later postoperative course. Her preoperative visual acuity, which was at the level of finger-counting, was held in a precarious balance by a postoperative external ventricular drain until the 10th day when the drain was removed because of the possibility of intracranial infection. Vision then fell to little above light perception. We felt that, had her intracranial pressure been reduced preoperatively and maintained postoperatively by a method devoid of the risk of infection, she would have retained useful

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vision. Ventricular shunting through the superior vena cava would have provided a safe decompression with minimal chance of infection.

We have now performed ventriculo-caval shunts for 15 patients in whom we suspected a posterior fossa tumor. Fourteen had papilledema; one had severe optic atrophy. In three, an initial external drainage was converted to a shunt when ventriculography showed complete obstruction of the aqueduct. In 12, a shunt was performed as the initial step. Technically, it has proved to be a very safe and simple procedure, especially if the external jugular vein is used, as is our custom. For some patients, it has been performed under local anesthesia and then amounts to no more than the sum of a burr hole and a superficial venous catheterization.

Six patients had cerebellar astrocytomas; one, a glioma of the pons; one, a brain stem glioblastoma; one, a neurinoma of the cerebellar pontine angle; one, an ependymoma of the fourth ventricle; two, metastatic tumors; one, an abscess of the cerebellar hemisphere; one, an increased intracranial pressure of undetermined etiology; and one, an optic neuritis. In those patients in whom the shunt was the initial procedure, radiological evaluation was undertaken 1 to 13 days later by pneumoencephalography or by air or positive-contrast ventriculography. Operation followed in 2 to 11 days, except in one patient with a brain abscess who deteriorated despite ventricular decompression and in whom operation was undertaken on the following day. The other 14 patients were unaffected or were improved following the decompression. There were no deaths in the series. At the definitive operation, general anesthesia was used. Pressure in the posterior fossa appeared to be low in all cases except in one, a very large cystic astrocytoma; there were no instances of herniated brain or distended blood vessels. All patients regained consciousness on the day of operation. The postoperative period of convalescence was short, and most patients were out of bed within a few days. Two patients with metastatic brain tumors and two with brain stem gliomas have since died, but the other members of the group are essentially symptom-free at postoperative intervals ranging from 2 months to 6 years. The usefulness of the procedure will be illustrated in the following two cases.

Report of Two Cases

Case 1. A 3½-year-old girl was admitted to the hospital on August 19, 1961, and was the first of the series. She had headaches, vomiting, ataxia, and bilateral papilledema. Ventricular drainage relieved her symptoms considerably, and ventriculography showed a tumor arising from the floor of the fourth ventricle, which it almost completely filled (Fig. 1A). On the same day, a ventriculocaval shunt was performed, and 3 days later the posterior fossa was explored. A tumor was verified as occupying the floor of the fourth ventricle. A very small biopsy, later shown to be an ependymoma, was taken, and this was followed by vigorous bleeding. Hemostasis was secured, the dura was left open, and the wound was closed.

Her postoperative course was absolutely uneventful. She received radiation therapy following the operation. The ventriculocaval tube, which had been inserted into the external jugular vein, did not go into the vena cava, but turned up the internal jugular toward the jugular bulb. About 1 year later, she had return of signs of increased intracranial pressure. Ventriculography showed no evidence of tumor in the fourth ventricle (Fig. 1B); it was presumed that, despite a radiographically open cerebrospinal-fluid pathway, she had become dependent upon her shunt tube, which had blocked. Exploration showed, in fact, that the shunt was blocked. A new shunt was inserted. This relieved her symptoms entirely, but it too became blocked on two separate occasions; in April, 1963, a third ventriculostomy had to be performed. Since that time she has remained symptom-free.

Thus, the insertion of the shunt provided definitive treatment for this child’s raised intracranial pressure during the period of evaluation and subsequent radiotherapy. As far as we know, she was the only patient in the series who became dependent upon her shunt tube. Presumably this would not have occurred had it been possible to establish the normal cerebrospinal-fluid pathways surgically at the time of craniectomy.

Case 2. The case of this 51-year-old woman illustrates the value of early care of the pres-