Subtemporal craniectomy for recurrent shunt obstruction secondary to small ventricles

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The authors report the cases of two shunt-dependent children with recurring ventricular catheter obstruction treated by subtemporal craniectomy with excellent results. It is suggested that the procedure permits some dilatation of the ipsilateral ventricle which in turn makes future catheter obstruction less likely.

KEY WORDS: hydrocephalus, subtemporal decompression

Hydrocephalus is currently treated by an assortment of shunting procedures, the common goal of which is to reduce the volume of the ventricular system to normal or near normal. Perhaps the most serious late complication of the procedure is total shunt dependency. In this condition the ventricles are often reduced to normal or subnormal size and occasionally even slits. Since the skull is no longer freely expansile, and alternative cerebrospinal fluid (CSF) absorptive pathways have long since ceased functioning, the child is totally dependent on the patency of the shunting system. Any element of obstruction rapidly causes serious and not uncommonly life threatening signs and symptoms of increased intracranial pressure. Unfortunately, the ventricular catheter often becomes trapped between the abutting ventricular walls, causing obstruction. Very often elevated intracranial pressure makes revision mandatory before there has been a significant increase in ventricular volume. Therefore, adequate replacement of the ventricular catheter may be difficult or even impossible. Once the catheter is replaced, the same problem is likely to recur as the previous vicious cycle is simply reactivated.

On the basis of previous laboratory investigation, it was hypothesized that subtemporal craniectomy would provide temporary relief from increased intracranial pressure while at the same time encouraging some dilatation of the ipsilateral ventricle, which in turn would protect against future catheter obstruction. This laboratory and clinical work is the subject of this report.

Laboratory Studies
Method

Adult cats were rendered hydrocephalic by the intracisternal injection of kaolin which obstructed the outlet foramina of the fourth ventricle. A few of these animals
were later subjected to hemicraniectomy and excision of the dura in order to observe its effect on the ipsilateral ventricle. This direction of investigation was based on the previous observation that with the calvarium removed and dura excised the volume of the ventricular system increased several times over that found in a hydrocephalic cat with the skull intact.4,5

Results

In all animals the hemicraniectomy resulted in ballooning of the ipsilateral ventricle (Fig. 1). It was therefore apparent that the skull and dura were important in maintaining ventricular volume in the presence of obstruction to spinal fluid pathways.

Case Reports

Case 1

This 18-month-old child had hydrocephalus secondary to aqueductal stenosis. She was treated with a right ventricular-jugular shunt shortly after birth and did well until 8 weeks prior to the present admission. At that time an emergency revision was performed for obstruction of the ventricular catheter. She did well for a few days, after which the ventricular catheter again became obstructed. Over the ensuing weeks, multiple revisions were necessary, but the catheter remained patent only temporarily. With each episode of obstruction, the child rapidly developed severe headaches and vomiting, and within a few hours became comatose. In desperation a right subtemporal craniectomy was performed. When the dura was opened, the brain immediately bulged through the decompression. It was then possible to replace the proximal catheter in the right lateral ventricle. The patient was immediately relieved of all signs and symptoms of increased intracranial pressure and remained so for 8 months, at which time the distal (peritoneal) catheter became dislodged. Despite the total obstruction, the child did not become seriously ill; apparently the subtemporal decompression vented the increased intracranial pressure. Elective revision was accomplished without difficulty, and the child is again doing well.

Case 2

At the age of 1 year this 9-year-old boy had had a right ventriculocisternal shunt for communicating hydrocephalus; this was converted to a ventriculopleural shunt when he was 4 years old. He then did well until a few months prior to the present admission when he developed severe headaches and vomiting which necessitated an emergency revision of the obstructed ventricular catheter. Over the ensuing 10 weeks two more proximal revisions brought only temporary alleviation of symptoms, and he was once again admitted, with recurring headaches, vomiting and recent deterioration in school work. The pump overlying the ventricular catheter remained depressed for several minutes after compression. A ventriculogram disclosed that the ventricles were small (Fig. 2). It seemed apparent that the child was suffering the effects of intermittent obstruction of the ventricular catheter secondary to small ventricles, and a right subtemporal craniectomy was performed (Fig. 3). During the 18 months since this procedure the child has remained asymptomatic. Occasionally, he experiences a mild headache at which time the decompression sometimes becomes full, but it invariably recedes after several hours.

Discussion

In 1926, Harvey Cushing1,2 introduced subtemporal craniectomy as one technique...
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for relieving increased intracranial pressure secondary to brain tumors. Some years later Walter Dandy advocated the procedure for cases of pseudotumor cerebri. Although occasionally performed for treating cerebral edema resulting from trauma or lead poisoning, the procedure has apparently not been included in the vast neurosurgical armamentarium used to treat hydrocephalus.

Subtemporal decompression ostensibly makes three important contributions to the long term management of shunt-dependent children. The first is that it vents the acutely increased intracranial pressure caused by the malfunctioning shunt, with the result that the symptoms become less fulminant and the need for emergency surgery is reduced.

This may be particularly advantageous with children who are not near the required neurosurgical facility. Second, there will be at least some degree of dilatation of the ipsilateral ventricle at the time of the shunt malfunction and therefore a greater likelihood of restoration of patency of the ventricular catheter. We have not yet had the opportunity to confirm this assumption by ventriculography. This is because the study must be performed at the time the shunt is malfunctioning, otherwise the ventricular size will have returned to normal. Finally, subtemporal craniectomy makes it possible for a palpating finger to estimate whether or not there is increased intracranial pressure. In the shunt-dependent child, even occasional headaches provoke anxiety. If, however, at the time of the headache the decompression remains soft or sunken, it will be apparent that a malfunctioning shunt is not likely. In both of our cases the parents learned to make this observation and actually became quite dependent on it.

References


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