An easily replaceable intracranial catheter

Technical note

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Replacement of a catheter draining an intracranial cyst or a ventricle can be difficult if the fluid space has collapsed. An intracranial catheter which can be safely and accurately exchanged is described. The catheter also offers an advantage during the original placement if the fluid cavity to be drained has a thick wall.

KEY WORDS □9 ventriculostomy □9 intracranial catheter

When hydrocephalic ventricles have been decompressed with a shunt or drainage tube, replacing the ventricular catheter can be a vexing problem. Such a circumstance occasionally arises when removal of a nonfunctioning ventricular catheter permits sufficient egress of ventricular fluid to cause enlarged ventricles to collapse. In circumstances in which the ventricles are already small, neurological deficits can result from repeated attempts to recannulate the ventricular system.

Intraoperative ultrasound can be of help in this situation, but some difficulty in ventricular cannulation will remain. Furthermore, if the sutures have closed, ultrasonic imaging will not be possible unless a sufficient window is made in the skull to permit its application. Another possible solution to this problem is to externalize the distal portion of the shunt and have it drain at gradually higher pressure levels so as to slowly increase ventricular pressure and size. This will permit replacement of the ventricular catheter when the ventricles have expanded. While useful, this technique requires two operations, may extend the period of hospitalization, and risks contamination of the system.

Consequently, it seemed desirable to develop a means of recannulating a ventricle utilizing the track of an already well-positioned catheter that was to be replaced with a new one. Similar considerations govern the replacement of catheters used for shunting or for draining intracranial cysts or other fluid collections. Such a technique would apply whenever it was acceptable to place the new catheter in the same site as the one being removed. The solution presented here involves the use of a hollow-tipped catheter which can be withdrawn and replaced over a flexible guide wire. The guide wire is maintained in the original catheter track during these maneuvers, thereby allowing accurate recannulation of a ventricle or cyst despite its collapse.

Description of Device and Technique

The catheter currently in use is made of Silastic.* It has a length of 110 mm, an outside diameter of 3.0 mm, and an internal diameter of 1.5 mm. It has numerous small lateral holes at the intracranial end, as do most ventricular shunt catheters; however, the catheter tip at this end has a 1.0-mm diameter hole in the axis of the catheter. This communicates with the 1.5-mm diameter of the channel within the entire remaining length of the catheter (Fig. 1).

The technique for initial placement of the ventricular

Replaceable intracranial catheter

**Fig. 2.** Photograph showing the obturator fashioned for use and the catheter with both guide wires in place. As shown here, the outer guide wire and catheter (lower) slide freely over the inner guide wire (upper).

or cyst catheter is the same as it would be for any of the common catheters now in use except that the obturator used must be of a diameter such that it cannot protrude through the hole at the catheter tip. While an obturator just under 1.5 mm thick would be appropriate, it was found sufficient to simply form a small blunt 1.9-mm wide loop at the tip of the usual 0.5 mm shunt catheter obturator (Fig. 2). Prior to ventricular or cyst cannulation, an attempt is made to push the tip of the obturator through the catheter tip. Experience indicates that, if the obturator does not protrude through the catheter tip when moderate pressure is applied, this is an adequate test of safety. In addition, the ability to easily remove the obturator from the catheter should also be verified. If the obturator is unsatisfactory, a slight modification of the width of the loop will suffice to correct the problem. After a satisfactory obturator fit has been obtained, the ventricle can be cannulated in the usual fashion and the shunt placement completed. A specially made obturator could be employed as an alternative.

The advantages of this system lie in the ease of replacing the intracranial catheter when the fluid compartment being drained has collapsed. This is accomplished by inserting two concentric flexible guide wires into the catheter. First, the overflow end of the intracranial catheter to be replaced is exposed at the cranial vault. The catheter is withdrawn a short distance and its wall grasped so as to prevent it from being pushed intracranially. A hollow flexible No. 304 stainless steel guide wire with a length of 130 mm, an outside diameter of 1.5 mm, and an inside diameter of 1.0 mm is threaded down the catheter. This guide wire cannot protrude through the hole at the catheter tip. If the length of the intracranial catheter is not known, the guide wire can be used to determine it, enabling the replacement catheter to be cut to an appropriate length. With this guide wire in place within the catheter, a longer inner No. 304 stainless steel guide wire with a length of 300 mm and outside diameter of 0.9 mm is threaded into the first guide wire for its full length (130 mm). Care should be taken to prevent this wire from advancing any further. The diameter of this second inner wire is less than the dimensions of the hole at the catheter tip, enabling the catheter and outer guide wire to be withdrawn over it (Fig. 2) and removed while maintaining the thin guide wire in position within the catheter track. It is then a simple matter to advance a new hollow-tipped catheter into position over the retained guide wire, which is then removed.

Aside from its ease of replacement, an additional advantage of the hollow-tipped catheter is in initial attempts to cannulate intracranial fluid pockets with thick walls. Difficulty has been encountered in doing this when the wall of a cyst has been sufficiently thick to deflect the catheter despite use of a stout obturator. Under such circumstances, a sharp cannula or hollow needle of sufficient inside diameter to accommodate the thin inner flexible guide wire described above has been utilized for catheter placement. After puncturing the wall of the fluid cavity with the needle, its obturator is removed and the guide wire is passed to the tip of the needle, which is then withdrawn over it. A hollow-tip catheter is then introduced into the cyst cavity over the guide wire. The wire is then withdrawn, completing the placement of the catheter.

**Comment**

Experience thus far has been in accord with expectations. Replacement of catheters into slit-like ventricles has been accomplished without tribulation. In one case, cannulation and shunting of a thick-walled intracranial cyst could only be accomplished with the maneuvers described above. Experience with this catheter is still limited, but there does not appear to be any reason to expect more frequent malfunction than with other existing types.

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