Ventricular catheter exchange using a peel-away outer catheter

Technical note

DAVID A. OMAHEN, B.Sc., M.D.,1 STEPHEN J. HENTSCHEL, M.D.,2 AND G. STUART CAMERON, M.D., M.S.2

1Division of Neurosurgery, Foothills Medical Centre, Calgary; and 2Division of Neurosurgery, Victoria General Hospital, Victoria, Canada

Ventricular catheter replacement can be challenging, especially in patients with small ventricles. Shunt malfunction due to ventricular catheter obstruction can occur without ventricular enlargement, such as in the setting of slit-ventricle syndrome or benign intracranial hypertension. The authors describe a simple technique for ventricular catheter exchange using a peel-away catheter. In the limited initial experience of the senior author (G.S.C.), this technique appears to be safe and effective. To the authors’ knowledge, this method has not been described in the neurosurgical literature before. (DOI: 10.3171/2011.4.JNS091879)

Key Words • hydrocephalus • ventriculoperitoneal shunt • ventricular catheter • diagnostic and operative techniques • slit ventricle • shunt revision

Methods

Materials

The technique requires a previously placed standard-sized ventricular catheter, the white sheath of a 9.5 Fr St. Jude peel-away catheter (St. Jude Medical), a surgical tie (we prefer a 3-0 Ethibond Tie), and a new standard-sized ventricular catheter. Figure 1 shows the relative sizes of the peel-away and ventricular catheters.

Description of Surgical Technique

The bur hole, valve, and ventricular tubing are exposed, and the ventricular catheter is freed. If the catheter is adherent, a Bugbee wire is passed through its lumen and a monopolar catheter is used in an attempt to free it.3 A 3-0 tie is tied securely around the in situ ventricular catheter just above the site of insertion through the bur hole (Fig. 2 upper). The free ends of the suture remain attached and are not cut. The catheter tubing is then cut a few millimeters distal to the suture (Fig. 2 lower). A 9.5 Fr diameter St. Jude catheter is cut to an appropriate length as follows. From the preoperative CT or MR image of the brain, we measured the length of the existing catheter and the distance from the bur hole to a point 2 cm within the ventricle. These points are marked on the sheath of the white St. Jude catheter with ink. Cut the sheath so that the tip will reach from 2 cm within the ventricle and protrude 3–4 cm out the bur hole. This diameter peel-away catheter just allows insertion of a standard-sized ventricular catheter through the lumen, without either binding or excess space. Next, mark the length of the sheath on the new ventricular catheter with ink. Do not cut the new catheter to final length yet.

The free ends of the tie are then threaded through the peel-away catheter in a distal-to-proximal direction (Fig. 3). Gently work the sheath over the catheter so its tip reaches 2 cm within the ventricle, using gentle counterclockwise force on the free ends of the tie to prevent inadvertent advancement of the old ventricular catheter.

Once the peel-away catheter is in place, the old ventricular catheter can be removed, using the strings of the tie if desired, leaving the sheath in place (Fig. 4). Insert the new catheter guided by the ink mark so that its tip is 2 cm in the ventricle. Carefully remove the sheath, leaving the new ventricular catheter in the ventricle (Fig. 5). Finally, advance the catheter to its final position, ensuring there is CSF flow, and using fluoroscopy if necessary. Cut the ventricular tube to length, attach the valve, and complete the shunt procedure.

Results

The senior author (G.S.C.) has selectively used this method for difficult catheter replacements for 3 years. Although the number of patients treated with the aforementioned method is small, no clinically apparent com-
Complications have been seen to date. Postoperative CT scans are routinely obtained. On occasion, a small amount of blood has been observed along the catheter tract, similar to what is sometimes observed after shunt insertion when using standard methods. Figure 6 shows examples of pre- and postoperative CT scans acquired in a patient in whom catheter exchange was performed using this technique.

Discussion

In neurosurgery the use of peel-away catheters enjoys widespread application during ventriculoscopic approaches to the cerebral ventricles and during catheter placement into the peritoneal cavity. The use of a Selding-
er wire-based method of catheter replacement has been previously described. To our knowledge, the method of using an external peel-away catheter has not been previously described in the literature. Unlike the Seldinger technique, our method does not require the distal end of the preexisting ventricular catheter to be open ended. In addition, our method does not require a patent catheter lumen. Others have described using a peel-away sheath to protect the holes in the proximal ventricular catheter from the intrusion of brain matter during insertion, in the hope of reducing shunt occlusions.

Although we have used this technique for ventricular catheter exchange in the setting of an indwelling ventriculoperitoneal shunt, the technique also seems suitable for external ventricular drain replacement.

Like all surgical techniques, this method is not without limitations or potential complications. The fact that the peel-away catheter is placed over the indwelling ventricular catheter means that, by necessity, a slightly larger tract is created through the brain. Potential exists to cause bleeding via traction on adhesions, or via shearing of blood vessels immediately adjacent to the tract. These risks may be outweighed by the fact that this technique obviates the need for multiple catheter passes in an attempt to cannulate the ventricle, especially in the setting of small ventricles. In addition, the length of the inserted peel-away catheter must be accurately calculated and marked, as there is little room for error, especially in the setting of small lateral ventricles, when this method is most likely to be used. Finally, this technique does not circumvent problems associated with removal of adherent ventricular catheters.

**Conclusions**

When a previously placed ventricular catheter must be replaced, this simple method can be used to position a new catheter in the same location. It is inexpensive and requires minimal equipment or technical expertise. It may be especially valuable in centers without access to image guidance. We have found this method especially useful in the setting of small or slit ventricles.

**Disclosure**

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Cameron. Drafting the article: Omahen. Critically revising the article: Hentschel. Administrative/technical/material support: Omahen, Hentschel.

**References**


Manuscript submitted June 14, 2010. Accepted April 25, 2011. Please include this information when citing this paper: published online May 20, 2011; DOI: 10.3171/2011.4.JNS101429.