Percutaneous Catheter Placement for Cyst Drainage in the Subarachnoid Space

Matthew J. Kuhn, Terrence Pencek, Donald H. Pearson, Brian K. Russell, and Scott D. Long

Summary: A technique for percutaneous catheter drainage of cystic masses in the subarachnoid space was developed and shown to be safe and effective in an 18-year-old boy with life-threatening, recurrent neuroenteric cysts that compressed the brain stem, cerebellum, and spinal cord. Percutaneous drainage through a C1-C2 approach was performed on 11 separate occasions. Decompression was always accomplished and no infection or other complication occurred, even with continuous catheter drainage for 9 months. This technique provides opportunities for interventional neuroradiologic therapy in the subarachnoid space. It appears to be suitable for percutaneous drainage of intraspinal and intracranial cysts when surgery is not indicated due to intractability or inaccessibility.

Index terms: Subarachnoid space, cysts; Catheters and catheterization, technique; Interventional instrumentation, drainage systems

Despite considerable expertise with spinal puncture derived from experience with myelography, interventional neuroradiologists have predominately concentrated upon angiographic techniques. In certain instances, therapeutic manipulation of catheters and wires using the Sel­dinger technique may also be applicable to the subarachnoid space. We present such a technique that was used on multiple occasions to relieve life-threatening spinal cord and brain stem compression in an 18-year-old with surgically unresectable intraspinal and intracranial cysts. His condition had rapidly deteriorated over the period of several days until he was referred to us in a moribund state.

Materials and Methods

Cyst puncture was accomplished by means of an 18-gauge needle passed through anesthetized skin and subcutaneous tissues, using the standard technique for direct cervical myelograph: a needle is advanced horizontally at the level of the junction of the middle and posterior thirds of the spinal canal at C1-C2 using lateral fluoroscopy. This method should preclude passing the needle into the carotid artery, vertebral artery, or spinal cord in most patients. In some patients (as in ours), in whom the cyst has displaced the spinal cord posteriorly, modification of needle position­ing becomes necessary.

When cyst fluid was encountered, contrast medium was injected through the needle to confirm location. Then, a 0.035-inch tapered core guide wire was passed into the cysts and guided cephalad. The needle was then removed and a 5-F pigtail catheter (Mallinckrodt Medical, Inc, St. Louis, MO) was guided over the wire and into the cysts. Contrast medium was again injected which showed the cysts to freely communicate among themselves but not with the surrounding subarachnoid spaces. Drainage of cyst fluid was then accomplished. Such drainage should be performed slowly to reduce the risk of tearing cortical veins and creating sudden shift of vital brain structures. We have removed up to 50 mL of fluid in a 15-minute interval. Drainage should be slowed if vital signs become unstable.

For treatment for infected cysts, both left- and right-sided punctures were performed. One of the catheters was passed caudally and the other cephalad. Following drainage of pus, antibiotics were delivered into one catheter and then drained from the other, thus assuring that most of the infected inner cyst wall had been in contact with the antibiotic.

After 3 to 4 weeks in the patient, the catheters occasion­ally became blocked with debris. They were then exchanged over a wire, using standard exchange techni­ques, for new catheters. When clogging became increas­ingly frequent or when a large amount of drainage was necessary, 6-F pigtail catheters (Mallinckrodt Medical) were positioned by standard catheter exchange techniques.

Results

Successful cyst puncture and drainage was readily accomplished in 11 out of 11 attempts. Although initially infected, the cysts were made...
sterile by antibiotic infusion. No bleeding or other complication of needle puncture occurred. No infection related to the catheter placement occurred, even when the catheter was left in place for several months and when the patient left the hospital. When necessary, catheter drainage was performed on a per-shift basis by ward nurses, without complication.

The patient had recurrent, pathologically proved neuroenteric cysts of the anterior cervical spine and prepontine space. Despite numerous surgical decompressions, the cysts continued to recur and to produce severe spinal cord, brain stem, and cerebellar compression (Figs 1A and 1B), resulting in clinical deterioration leading to coma. Following percutaneous cyst puncture and drainage (Fig. 1C), the posterior fossa structures were decompressed and took on a much more normal appearance. Originally, left-sided catheter drainage was performed, but it was expedient to have two catheters (Figs. 1D and 1E) for the purpose of optimal antibiotic administration and drainage. Following each drainage, the patient’s clinical condition and neurologic status dramatically improved. He was able to leave the hospital for short periods of time and to attend his high school graduation with the drainage tubes in place.

![CT of the head at the level of the posterior fossa](image1.png)  
**Fig. 1.**  
*A,* CT of the head at the level of the posterior fossa shows numerous low-density cysts compressing the brain stem and cerebellar hemispheres.  
*B,* T2-weighted axial MR image shows numerous T2 bright cysts compressing posterior fossa structures.  
*C,* Following cyst decompression with a pigtail catheter, the posterior fossa has a more normal appearance.  
*D,* CT at C1-C2 shows two drainage catheters entering at this level.  
*E,* Plain film of the head and neck shows both pigtail catheters in position.
Discussion

The use of catheters to introduce anesthetic agents into the spinal column during surgical procedures is widespread. Chemotherapeutic agents, particularly methotrexate, are administered into the subarachnoid space via lumbar puncture. But to our knowledge, percutaneous drainage of the intraspinal cysts and placement of a semipermanent catheter system has not previously been attempted.

Neuroenteric cysts are also known as teratoma-like cysts, enterogenous cysts, enterocysts, and neuroepithelial cysts (1–3). Although their exact pathogenesis is somewhat controversial, they are believed to result from the abnormal separation of germ layers in the third week of embryonic life (1, 4, 5, 6, 7). The majority of cysts are located within the cervical region (5–8). Clinically, neuroenteric cysts produce symptoms of spinal cord compression, with two hallmark features: 1) pain is a prominent sign, and 2) the clinical history may be marked by periods of remission (4, 5, 6, 9). Patients are more often males than females (3:2) and between the ages of 20 and 40 years of age (4–6). Currently, the treatment of choice in these patients and others with clinically significant intraspinal cysts involves surgical drainage of the cyst contents and excision of the cyst wall (5, 8). However, the cysts often recur and become difficult to manage due to their deep locations (5).

It became necessary to use percutaneous catheter placement to decompress neuroenteric cysts in this patient. It was felt that there was no longer any benefit to be derived from repeated surgical drainage. There might be indications for percutaneous drainage in patients with other surgically unmanageable disorders, including infected or sterile arachnoid cysts, Dandy-Walker cyst, or syringohydromyelia.

There are many dangerous risks associated with this procedure: injury to the vertebral or carotid arteries might occur if the needle or the catheter passes through these vessels; nerve, spinal cord, or brain injury might result from traumatic placement of the catheter, wire or needle; meningitis could result from long-standing percutaneous catheter placement. It is encouraging that these complications did not occur in our patient, but extreme caution must be exercised in both patient selection and percutaneous technique.

The percutaneous placement of a catheter through a C1-C2 approach for drainage and direct antibiotic administration of intraspinal and intracranial cysts appears to be clinically efficacious in certain instances. Although it is difficult to speculate on the universal application of the technique at this time, it may offer a safe and relatively noninvasive surgical alternative in highly selective cases.

References