Treatment of postoperative cerebrospinal fluid fistulas by subarachnoid drainage

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The authors report the details of the successful treatment of 11 of 12 patients with postoperative cerebrospinal fluid fistulas. Continuous lumbar or ventricular fluid drainage was used.

KEY WORDS • cerebrospinal fluid • fistula • rhinorrhea • pseudomeningocele

POSTOPERATIVE cerebrospinal fluid (CSF) leaks have plagued surgeons and their patients since the beginning of intracranial surgery. From the time of Dandy's initial operative repair of a CSF fistula almost 50 years ago, surgical correction has remained the treatment of choice for these problems. It has, however, been occasionally suggested that lowering CSF pressure with serial lumbar punctures might allow spontaneous healing of CSF leaks. Vorc'h and Rougerie, successfully used continuous drainage of lumbar spinal fluid rather than serial lumbar punctures to treat CSF leaks, and White, et al., described a closed continuous ventricular drainage system. This latter method significantly decreased the risk of infection inherent in external CSF diversion.

We have modified White's method by adapting it to lumbar as well as ventricular drainage and are reporting our experience with this technique.

Method

Figure 1 shows how lumbar drainage is established. A 17-gauge Touhy needle* is inserted in the L3-4 interspace. A 19-gauge epidural catheter is advanced cephalad through the needle bore to approximately the level of the T12-L1 interspace. When CSF flow is adequate, sterile standard intravenous tubing is attached to the adapter on the catheter and inserted into an empty plastic blood collection bag. The unused portion of the catheter is taped to the skin and brought around the flank to the patient's abdomen. This allows the patient to lie in either the recumbent or lateral decubitus position during the 48 to 72 hours of drainage. The rate of drainage may be varied by altering the height of the bag, although it has usually been adequate to tape the bag to the patient's abdomen.

*Touhy needle manufactured by Becton-Dickinson and Company, Rutherford, New Jersey.
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Fig. 1. Drawing of apparatus for lumbar subarachnoid drainage. The catheter is inserted into the L3–4 interspace and advanced cephalad to the level of the T12–L1 interspace.

Fig. 2. Drawing of apparatus for continuous ventricular drainage. The pressure-regulated valve fits into the port of the blood collection bag.

Ventricular drainage has been used in cases where lumbar drainage has failed, the leak has been large, or long-term diversion has been anticipated. This is established after the manner of White, et al.5 (Fig. 2). Like lumbar drainage, ventricular CSF diversion is a completely closed system; the difference is that a subcutaneous reservoir has been incorporated to allow CSF sampling or injection of antibiotics if necessary. A pressure-regulated valve fits snugly into the port of the blood collection bag. Thus, patients may be ambulatory without rapid loss of CSF or reflux of the contents of the bag into the ventricles. This system has been used for up to 4 weeks of continuous drainage.

Results

Table 1 summarizes the clinical data and results in 12 patients treated with continuous CSF drainage.

Lumbar Drainage

Lumbar drainage alone was used in nine patients. Four of these had postoperative rhinorrhea, and one had an incisional leak after an intracranial procedure. Fistulas were successfully sealed within 48 to 72 hours of drainage in four of these five patients; the single failure in this series was in a 16-year-old girl with a trigeminal neurinoma partially resected through a transmaxillary exposure.
J. McCallum, J. C. Maroon and P. J. Jannetta

**TABLE 1**

Summary of patients with fistulas treated by closed drainage of cerebrospinal fluid

<table>
<thead>
<tr>
<th>Age, Sex</th>
<th>Site of Leak</th>
<th>Surgical Procedure</th>
<th>Infection*</th>
<th>Duration of Leak</th>
<th>Results</th>
<th>Period of Follow-up (mos)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pre.</td>
<td>During</td>
<td>Post.</td>
<td></td>
</tr>
<tr>
<td><strong>Patients with lumbar drainage</strong></td>
<td></td>
<td></td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>17 days</td>
</tr>
<tr>
<td>18 F</td>
<td>nose</td>
<td>transphenoidal</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>5 days</td>
</tr>
<tr>
<td>25 M</td>
<td>nose</td>
<td>transphenoidal</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>5 days</td>
</tr>
<tr>
<td>52 F</td>
<td>nose</td>
<td>transphenoidal</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>5 days</td>
</tr>
<tr>
<td>16 F</td>
<td>nose</td>
<td>transmaxillary</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>2 wks</td>
</tr>
<tr>
<td>20 F</td>
<td>postauricular</td>
<td>translabyrinthine &amp; suboccipital resection of acoustic neurinoma</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>3 days</td>
</tr>
<tr>
<td>29 F</td>
<td>dorsal thoracic incision</td>
<td>thoracic laminectomy (arachnoid cyst)</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>7 wks</td>
</tr>
<tr>
<td>62 M</td>
<td>dorsal thoracolumbar incision</td>
<td>thoracolumbar laminectomy with dural graft (arachnoiditis)</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>10 days</td>
</tr>
<tr>
<td>60 M</td>
<td>dorsal cervical incision</td>
<td>open cervical cordotomy (pain 2° carcinoma)</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>18 days</td>
</tr>
<tr>
<td>62 F</td>
<td>dorsal thoracic incision</td>
<td>open thoracic cordotomy (pain 2° carcinoma)</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>10 days</td>
</tr>
<tr>
<td><strong>Patients with ventricular drainage</strong></td>
<td>ear</td>
<td>temporal bone resection (carcinoma)</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>2 days</td>
</tr>
<tr>
<td>50 M</td>
<td>ear</td>
<td>temporal bone resection (carcinoma)</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>5 mos</td>
</tr>
<tr>
<td>60 M</td>
<td>ear</td>
<td>temporal bone resection (carcinoma)</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>6 wks</td>
</tr>
</tbody>
</table>

* Presence of infection before, during, and after drainage.

She had postoperative CSF rhinorrhea that ceased with lumbar drainage; however, 4 weeks after hospital discharge she was readmitted with pneumococcal meningitis and CSF rhinorrhea. The meningitis was successfully treated and the rhinorrhea ceased spontaneously and has not recurred in the ensuing 18 months.

The other four patients treated with lumbar drainage had CSF leaks from the spinal sub-

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arachnoid space. These patients had had recent laminectomies complicated by postoperative pseudomeningoceles or fistulas (Table 1). Silastic dural grafts had been employed in two of these cases. All four leaks were successfully treated with continuous drainage.

Ventricular Drainage

The three patients treated with ventricular drainage had all developed CSF leaks following temporal bone resection. In each case, the dura had been torn in several places and a wide, infected fistula had developed. All three patients had gram-negative meningitis prior to drainage; the fistulas had been present for 2 days, 6 weeks, and 5 months, respectively. The drains were left in place with the patients ambulatory for 4 to 6 weeks. Meningitis cleared and the wounds healed in each case. No leaks have recurred in this group of patients.

Discussion

Infection is the most serious complication of CSF fistula and of CSF diversion. No infections were attributable to drainage in these patients; rather, two infections present prior to drainage cleared after use of the technique. This was verified with CSF cultures taken daily from patients on lumbar drainage and intermittently from those on ventricular drainage. Although antibiotics were given to the three patients with infection prior to drainage, they were not used prophylactically. Spinal fluid pleocytosis was encountered during drainage in one case; this patient was asymptomatic and multiple CSF cultures were sterile.

The rate of CSF drainage varies considerably among patients. In this group, the range has been 60 to 600 cc/24 hours. If drainage is too slow, the leak persists. If it is too rapid, nausea, headache, and diaphoresis may occur; this clinical state can be reversed by administration of oral or intravenous fluids and slowing the rate of drainage.

The principle of fluid diversion to allow healing of fistulas has ample precedent in other surgical fields, but has been infrequently used in neurosurgery. Vourc'h and Rougerie and, subsequently, Aitken and Drake demonstrated that postoperative CSF fistulas could be successfully treated with lumbar spinal fluid drainage. Indeed, McCoy has shown experimentally that granulation tissue formation is accelerated at the site of CSF fistulas, but fluid diversion is a prerequisite to healing. White, et al. showed that CSF could be drained externally without undue risk of infection. Safe external drainage of CSF and rapid healing of fistulas has been characteristic in our experience. In fact, leaks became sealed in spite of artificial dural substitute, large overlying bone defects, and infection at the site of the fistula.

References


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