Endoscopic Fenestration Procedures to Cerebral Arachnoidal Cysts

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Introduction

Arachnoid cysts are intra-arachnoidal collections of cerebrospinal fluid. They are regarded as a developmental abnormality of the arachnoid, originating from a splitting or duplication of this membrane.
 Mostly congenital in origin, they once were estimated to account for approximately 1% of all atrumatic intracranial mass lesions. With the advance of imaging techniques, the incidence rate seems to be higher. Common clinical onset includes headache, seizures, and focal neurological signs but asymptomatic cases are not rare. Between 50% and 65% occur in the middle cranial fossa, with another 10% each in the suprasellar and quadrigeminal regions. The frontal convexities account for 5% and the posterior cranial fossa for about 8%.

Indications for treatment are the progression of symptoms, the presence of severe neurologic disorders, and endocrinologic dysfunction. Many operative procedures for the therapy of arachnoid cysts have been recommended, however it remains controversial as to which is the best method. They are stereotactic aspiration, cyst excision, cyst fenestration, cystocisternostomy, ventriculocystostomy, and cystoperitoneal shunting. Recently a few authors reported successful management of arachnoid cysts using endoscopic system. We report on our experience with a series of five consecutive patients with arachnoid cysts treated endoscopically.

**Materials and Methods**

Five consecutive patients with arachnoid cysts were treated endoscopically at our institution between January 1995 and December 1996. A prospective study of each case was performed, including neurological examinations and CT or MR imaging before surgery and at 1, 3, 6, and 12 months postoperatively.

The clinical characteristics of the patients are given in Table 1. There were 3 females and 2 males. The age of the patients at the time of diagnosis ranged from 2 to 62 years. Two cysts were located in the middle cranial fossa, 2 in the suprasellar area, and 1 in the posterior cranial fossa. The patient’s symptoms included headache, vomiting, nausea, dizziness, balancing problems, visual disturbance, and seizure. The neurological examination on admission were gait disturbance and urinary incontinence in case 1, cerebellar signs in case 4, and bitemporal hemianopsia in case 5.

Computerized tomography (CT) and magnetic resonance (MR) imaging demonstrated a mass effect of the cysts on neighboring brain tissue with flattening of gyri, compression and the ventricular system, and/or midline shift in all cases except case 5. Cine-phase contrast MRI was also made to study CSF flow dynamics.

**Operative Procedures**

All procedures were performed under general endotracheal anesthesia. The field of operation was prepared and draped to allow immediate open microsurgical intervention in cases of complications. We used rigid endoscope (Karl Storz GmbH & Co, Tuttingen, Germany and Aesculp, Tuttingen, Germany) with or without stereotaxic frame (CRW, Radionics, Burlington, USA).

In cortical cysts, a burr hole was made according to the best trajectory obtained from imaging and the dura was opened. The outer membrane was coagulated and incised. The endoscopy was inserted free-hand into the cyst to inspect. After orientation, fenestration procedure started. In case 2 and 4, a cystocisternostomy was performed by creating a wide

<table>
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<tr>
<th>Case</th>
<th>Sex/ Age</th>
<th>Clinical findings</th>
<th>Location</th>
<th>Procedure</th>
<th>Follow up</th>
<th>Outcome</th>
<th>Image change</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>M/ 2</td>
<td>Gait disturbance</td>
<td>Suprasellar</td>
<td>Ventriculo-cysto-cisternostomy</td>
<td>21 Mo</td>
<td>No Cx</td>
<td>Cyst reduction</td>
</tr>
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<td>2</td>
<td>F/14</td>
<td>Headache, dizziness</td>
<td>Middle fossa</td>
<td>Cysto-cisternostomy</td>
<td>18 Mo</td>
<td>Bleeding</td>
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<tr>
<td>3</td>
<td>F/60</td>
<td>Seizure, generalized</td>
<td>Parietal</td>
<td>Cysto-ventriculostomy</td>
<td>14 Mo</td>
<td>No Cx</td>
<td>Cyst reduction</td>
</tr>
<tr>
<td>4</td>
<td>M/60</td>
<td>Headache, cerebellar sign</td>
<td>Cerebellar</td>
<td>Cysto-cisternostomy</td>
<td>16 Mo</td>
<td>No Cx</td>
<td>Disappeared</td>
</tr>
<tr>
<td>5</td>
<td>F/62</td>
<td>Visual defect, headache</td>
<td>Suprasellar</td>
<td>Ventriculo-cystostomy</td>
<td>12 Mo</td>
<td>No Cx</td>
<td>Cyst reduction</td>
</tr>
</tbody>
</table>

M : male, F : female, Mo : month, Cx : complication
opening with monopolar coagulator, scissor, and For-
gaty balloon catheter. In case 3, a cysto-ventriculos-
tomy was done (Fig. 1). In suprasellar cysts (case 1
and 5), a burr hole was placed at right Koch’s point
and the ventricle was punctured by 12.5Fr peel-away
catheter (Codman, Randolph, USA). The rigid ven-
triculroscope (Aesculap, Tuttlingen, Germany) was in-
serted and fenestration procedure was performed. A
ventriculo-cystostomy was performed in the bulged
floor of the third ventricle (Fig. 2).

Minor bleeding was easily controlled with copious
irrigation. But in one case of a middle fossa cyst (case
2), significant bleeding occurred. Because this pre-
vented orientation and a safe operation, the endos-
copic operation had to be abandoned and an open
craniotomy was performed. The follow-up periods
ranged from 6 to 18 months.

Results

The was no mortality and morbidity. Symptoms
were relieved in all 5 patients. The follow-up MR im-
ages or CT scans revealed a decrease in the size of
the cysts, and neurologic examinations were unremarkable in 3 patients. Gait disturbance in case 1,
cerebellar sign in case 4, and bitemporal hemianopsia
in case 5 disappeared. At the 12 month follow-up,
seizure disappeared and no antiepileptic drugs were
required in case 3. Other subjective symptoms were
improved remarkably in all patients. All cysts showed
asynchronous CSF pulsation without specific in- or out jet-flow on cine MR CSF flow images. Especially, outstanding improvement of trans-aqueductal ventricular flow was visible postoperatively in case 1.

Discussion

Development and natural history of arachnoid cysts remain controversial. There are two main hypotheses supported by objective findings: the active fluid secretion and the pulsatile pump. There is ultrastructural evidence of microvilli on the cysts luminal surface. This fact could support the active secretion theory. However, it may also be interpreted only as a reactive arachnoid differentiation providing an absorptive mechanism. Caemaert and D. Santamarta found the slit in the cyst with endoscopy. They reported the mechanism what cysts enlarge could be explained by the presence of a slit in their wall that would act a functional one way valve. And the arterial inflow and elasticity of the cyst wall is responsible for an cyst enlargement.

The treatment of arachnoid cysts is another interesting and controversial subject. Arachnoid cysts most commonly have been treated by cyst fenestration/resection or by cystoperitoneal shunting, however, controversy continues regarding which surgical treatment is best. Open surgery for removal or fenestration is considered as a rather aggressive and often infective procedure. Shunting is a blind procedure with the risk of failure in getting inside the cyst because the wall of the cysts is tough enough to deviate the catheters tangentially, and it is accompanied by a higher incidence of additional surgical procedures and the disadvantage of life-long shunt dependence. Endoscopic techniques can replace open surgery or shunting procedures with similar or even better results.

The reports of successful endoscopic treatment of arachnoid cysts are gradually increased. It proved to be an effective and safe technique in our series. The symptoms of the patients treated purely endoscopically were relieved completely. In all patients the size of the cysts decreased remarkably after surgery. In cases of traumatically perforated cysts, these were not operated and spontaneously healed after several months as in operated cases. It supports the minimal fenestration procedure as possible as preserving internal environment is very valuable for the management of cerebral arachnoid cysts. The maintenance of opening is very important. Caemaert, et al., prefer a wide endoscopic fenestration into the lateral ventricle using a Nd-YA-YAG laser. The opening should be as large as possible (10–15 mm) to prevent later closing. Schroeder, et al., perforated the cyst wall by means of bipolar coagulation and enlarged the perforation with a Fogarty catheter. To prevent closure of the opening by scarring, they subsequently inserted a fimbrial catheter. The basic mechanism of cyst formation is the one-way slit valve. We believe that the proportion of opening to cyst volume may be more important than the absolute size of opening.

Although the follow-up period is too short to make statements on long-term outcome, the author recommend the minimally invasive endoscopic approach for treatment of arachnoid cysts as the first therapy of choice. Should the endoscopic procedure fail, established treatment options can subsequently be performed without additional risk.

References


20) Lange M, Oeckler R: Results of surgical treatment in patients with arachnoid cysts. Acta Neurochir 1987; 87: 99-104