Third ventricle colloid cysts: a consecutive 12-year series

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A continuous follow-up review of colloid cysts including aspects of natural history and evaluation of treatment options is necessary to optimize individual treatment. Thirty-seven consecutive patients with colloid cyst of the third ventricle seen at Karolinska Hospital between 1984 and 1995 were reviewed. Five patients were admitted in a comatose state, and two died despite emergency ventriculostomy. Three had recurrent cysts following previous aspiration procedure. During the study period, patients underwent a total of 10 ventriculostomies, 10 aspirations, 26 microsurgical operations, and two shunt operations.

Twenty-four of 26 microsurgical operations were transcallosal and two were transcortical. Twenty-four operations (22 transcallosal and two transfrontal approaches) without permanent morbidity were performed by four surgeons. Transient memory deficit from fornical traction was noted in 26%. The remaining two transcallosal operations, which led to permanent morbidity or mortality, were performed by two different surgeons. Aspiration of cysts performed by four different surgeons carried a 40% risk of transient memory deficit (10% permanent) and an 80% recurrence rate. One patient was found to be cured on radiological studies obtained at the 5-year follow-up review.

Seven cysts were followed by means of radiological studies with no treatment for 6 to 37 months. Five of these cysts grew, indicating that younger patients with colloid cysts will probably need surgical treatment.

The main causes of unfavorable results were: 1) failure to investigate symptoms that proved fatal; 2) subtotal resection; and 3) surgical complications. Transcallosal microsurgery produced excellent results when performed by experienced surgeons. A colloid cyst of the foramen of Monro is a disease that should be detected before permanent neurological damage has occurred. Permanent morbidity or mortality should not be accepted in modern series of third ventricle colloid cysts.

KEY WORDS • familial occurrence • apoplexy • transcallosal approach • aspiration • endoscopy

Colloid cyst of the third ventricle is a rare intracranial tumor comprising 0.5 to 1% of primary brain tumors,43 and its treatment has been the subject of some controversy. A literature review indicates that surgical techniques, relevant surgical considerations, and possible complications change rapidly. The first surgically treated cases were reported by Dandy.13 The morbidity and mortality of surgical removal associated with the premicrosurgical era were unacceptable by today’s standards.13,29,33 Palliative approaches such as free-hand aspiration, stereotactic aspiration, or endoscopic aspiration have been reported to minimize surgical risk.5,20,34,35,37,38 Aspiration procedures had a low rate of initial success, with high rates of recurrence.26,31 Reports of microsurgical series have described good results with transcortical removal of cysts.1,2,9,12,17,36 Lately, endoscopic procedures have been reported to yield satisfactory results, but these cases have limited follow-up review.7,14,15,28

In spite of a generally favorable attitude toward transcallosal surgery for colloid cyst, only limited numbers of patients have been reported. This paper reports a series of patients who have undergone transcallosal microsurgery and compares them with patients who have undergone aspiration. A consecutive 12-year series of patients managed at our institution was analyzed.

Clinical Material and Methods

Thirty-seven consecutive patients (11 female, 26 male; for age distribution see Fig. 1) presenting with a colloid cyst of the third ventricle at Karolinska Hospital between January 1, 1984 and December 31, 1995 were reviewed (Table 1). Their charts were analyzed and the patients were followed at the outpatient clinic. Neurological status and memory function were determined by a clinical examination. The Glasgow Outcome Scale (GOS) score at 6 months was recorded. Briefly, a GOS score of 5 is independent and asymptomatic, 4 is independent with moderate neurological symptoms, 3 is dependent and unable to care for self, 2 is vegetative, and 1 is dead.25

Presenting Symptoms

The main preoperative symptom was headache in 19 patients (mean age 35 years; duration of headaches 1 day–8 years; mean 16 months). Seven of these patients
had additional symptoms of increased intracranial pressure (ICP) including confusion, nausea, depressed consciousness, or coma at admission. The headaches were described as intermittent attacks in eight patients. The cyst was recurrent after treatment administered before the study period at our or another institution in four of these 19 patients (mean duration of recurrent symptoms 15 days). Additional symptoms were unilateral leg weakness (two patients) and episodes of transient global amnesia (one patient).

### TABLE 1: Demographic and clinical characteristics in 37 patients with colloid cysts of the third ventricle*

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs), Sex</th>
<th>Presenting Symptom</th>
<th>Duration</th>
<th>Attenuation</th>
<th>Cyst Size (mm)</th>
<th>Treatment</th>
<th>Surgical Outcome</th>
<th>2 Days</th>
<th>6 Mos</th>
<th>Hydrocephalus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56, M</td>
<td>NPH</td>
<td>1 yr</td>
<td>high</td>
<td>46 transcall</td>
<td>mutism, mem def</td>
<td>GOS 5</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>69, M</td>
<td>NPH</td>
<td>3 mos</td>
<td>high</td>
<td>16 transcall</td>
<td>stupor</td>
<td>GOS 1</td>
<td>+, 3rd ventricle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>17, M</td>
<td>headache, drop</td>
<td>1 day</td>
<td>high</td>
<td>7 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>32, F</td>
<td>headache, hern (r)</td>
<td>1 day</td>
<td>high</td>
<td>9 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>8, F</td>
<td>headache</td>
<td>3 yrs</td>
<td>high</td>
<td>transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>31, F</td>
<td>headache</td>
<td>8 yrs</td>
<td>high</td>
<td>transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>28, M</td>
<td>incidental</td>
<td>—</td>
<td>high</td>
<td>10 transcall</td>
<td>mem def</td>
<td>GOS 4</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>56, F</td>
<td>headache (r)</td>
<td>15 yrs</td>
<td>high</td>
<td>15 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+, 3rd ventricle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>13, M</td>
<td>headache</td>
<td>3 mos</td>
<td>low</td>
<td>12 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10†</td>
<td>12, F</td>
<td>headache</td>
<td>unknown</td>
<td>high</td>
<td>7 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>64, M</td>
<td>NPH</td>
<td>2 mos</td>
<td>low</td>
<td>21 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>73, M</td>
<td>NPH</td>
<td>3-4 mos</td>
<td>high</td>
<td>18 transcall, shunt</td>
<td>unchanged</td>
<td>GOS 4</td>
<td>+, 3rd ventricle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>42, F</td>
<td>NPH</td>
<td>3 yrs</td>
<td>iso</td>
<td>12 transcall</td>
<td>mem def</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>44, M</td>
<td>mem def</td>
<td>10 days</td>
<td>iso</td>
<td>18 transcall</td>
<td>mem def</td>
<td>GOS 5</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>56, M</td>
<td>headache</td>
<td>4 mos</td>
<td>high</td>
<td>8 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>43, F</td>
<td>headache (r)</td>
<td>2 yrs</td>
<td>low</td>
<td>10 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+, 3rd ventricle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>36, M</td>
<td>headache</td>
<td>1 yr</td>
<td>high</td>
<td>6 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>36, M</td>
<td>incidental</td>
<td>—</td>
<td>high</td>
<td>8 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>39, F</td>
<td>headache</td>
<td>4 yrs</td>
<td>high</td>
<td>10 transcall</td>
<td>0</td>
<td>GOS 5</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>31, M</td>
<td>routine check (r)</td>
<td>—</td>
<td>high</td>
<td>8 transfront</td>
<td>mem def</td>
<td>GOS 5</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>38, M</td>
<td>headache, coma (r)</td>
<td>1 day</td>
<td>low</td>
<td>50 st asp, ventric</td>
<td>mem def, blind</td>
<td>NA‡</td>
<td>+++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>44, F</td>
<td>headache (r)</td>
<td>4 yrs</td>
<td>high</td>
<td>21 transcall</td>
<td>0</td>
<td>NA (r) at 11 days‡</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>50, F</td>
<td>NPH</td>
<td>7 days</td>
<td>iso</td>
<td>15 st asp, ventric</td>
<td>0</td>
<td>GOS 5 (r)</td>
<td>++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>51, F</td>
<td>headache, nausea§</td>
<td>5 yrs</td>
<td>low</td>
<td>12 st asp, ventric, scp</td>
<td>mem def</td>
<td>GOS 5 (r)</td>
<td>–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>41, M</td>
<td>headache, nausea</td>
<td>2 days</td>
<td>high</td>
<td>16 st asp, ventric, scp</td>
<td>0</td>
<td>GOS 5 (r)</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>48, M</td>
<td>headache, mem def§</td>
<td>3 mos</td>
<td>high</td>
<td>17 st asp</td>
<td>repeat treatment (r)</td>
<td>+++</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>41, M</td>
<td>incidental (symptoms caused by cerebellar infarction)</td>
<td>—</td>
<td>high</td>
<td>10 st asp, scp</td>
<td>coma</td>
<td>GOS 1</td>
<td>+</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* An (r) in the Symptom column indicates that the patient was admitted with a recurrent cyst, whereas in the Outcome column (r) means that the outcome was recurrent/residual cyst. Abbreviations: drop = drop attack; hern = herniation; mem def = memory deficit; NA = not applicable; scp = ventriculostomy; st asp = stereotactically guided aspiration; tinn = tinnitus; transcall = transcallosal; transfront = transfrontal; ventric = ventriculostomy; 0 = no morbidity; + = minimal widening of lateral ventricles; ++ = moderate widening; +++ = marked widening; 3rd ventricle = widening includes 3rd ventricle, as in NPH.

† Age and size of cyst in this case refer to data at time of treatment.

‡ Patient underwent repeat operation using a different procedure before 6-month follow-up review.

§ Comatose before treatment.

‖ Patient herniated following lumbar puncture at the referring center and arrived in a brain-dead state.
Third ventricle colloid cyst

![Bar graph showing age distribution of patients with colloid cyst. Values represent age at first diagnosis.](image)

Nine patients (mean age 56 years) were investigated for symptoms of normal-pressure hydrocephalus (NPH), including gait disturbance, incontinence, and/or psychologic disturbances; the duration of symptoms was 1 to 36 months (mean 11 months). The cysts were recurrent in three of these nine patients with a mean duration of recurrent symptoms of 10 months.

The remaining nine patients had miscellaneous presenting symptoms. The cysts were incidental findings in four patients without specific symptoms of a colloid cyst (mean age 51 years). Three patients were investigated because of an isolated memory disturbance (mean age 40 years, mean duration of symptoms 3 weeks). In two patients (Cases 32 and 33), the cysts were detected at routine follow-up examination of these asymptomatic patients who underwent aspiration procedures before the study period. The patient in Case 26 was admitted with a recent hemorrhage in the cyst.

**Recurrent Cysts**

Nine of the 36 patients had been treated before the study period, eight with stereotactic aspiration (seven at Karolinska Hospital), and one was treated at another institution with a simultaneous transfrontal microsurgical procedure for a colloid cyst, an arterial aneurysm, and a convexity meningioma. Seven patients have been presented in a previous report on recurrence following stereotactic aspiration of a colloid cyst, and one (Case 25) was included in a preliminary report on aspiration of colloid cysts.

**Treatment Groups**

The patients underwent a total of 10 ventriculostomies, 10 aspirations, 26 microsurgical operations, and two shunt operations during the study period. The patients were reported under several headings: patients admitted in coma, patients treated by aspiration, patients not treated, patients receiving follow-up care for some time without any treatment, and patients undergoing microsurgical extirpation. In the latter group a distinction is made between two patients undergoing operation by two surgeons who treated one patient each, and 23 patients (24 operations) treated by four other surgeons. The reason was that increased experience in the treatment of this kind of lesion influenced results.

**Stereotactic Aspiration**

The cysts were localized by computerized tomography (CT) using Leksell frames (Elekta, Stockholm, Sweden). Stereotactic coordinates were calculated, appropriate burr holes were made after local anesthesia was induced in the patient, and trocars were introduced. The cyst capsule was perforated with a thin sharp needle, followed by an attempt at biopsy with a spiral needle. Vigorous aspiration was used to empty the cyst. The procedures were performed with endoscopic guidance using a rigid lens scope in seven of 10 procedures (Cases 21 and 24–29; the second procedure only in Case 26). Ventricular drainage was not routinely used.

**Transcallosal Microsurgical Removal**

Twenty-three of the microsurgical operations were transcallosal. The following protocol was used for the last operations reported. The patient’s head was elevated and turned to the right to allow the hemisphere to fall away from the midline. A straight incision was made along the coronal suture without shaving any hair. A free bone flap measuring 2.5 × 5 cm was made parasagittally. The medial burr holes were placed on the side of the superior sagittal sinus. The bone flap was sawed obliquely in the midline, leaving a generous portion of the tabula externa extending across the midline on the free flap. The remaining bone of the tabula interna covering the sinus was removed with a high-speed drill. Bridging veins in the operating field were dissected sharply from the arachnoid to obtain operating space in the midline without sacrificing any veins. Arachnoidal adhesions and the arachnoid of the corpus callosum cistern were opened sharply. The pericallosal arteries were dissected sharply and the right artery was held laterally and protected with a tapered 2-mm spatula. A 1-cm callosotomy was made to reach the lateral ventricle. The spatula was advanced to keep the callosotomy open while a second spatula was introduced medially. The cyst became visible in the foramen of Monro. The visible part of the cyst was freed from surrounding plexus and the central veins and incised to allow evacuation of its contents through the foramen of Monro. After decompression, the cyst wall was dissected from the third ventricle and removed. A small portion of the cyst wall was left adherent to the internal cerebral veins to avoid the risk of uncontrolled venous bleeding in two patients. The dura was closed with a pericranial graft to secure watertight closure. Ventriculostomy was not used routinely.

In contrast, the cyst was delivered in toto through the foramen of Monro in six patients (Cases 5, 7, 13, 14, 20, and 22). The Steiner–Lindquist laser localizer was used to allow for a minimal callosotomy in three operations (Cases 5, 10, and 14). Two patients underwent a transcortical frontal procedure (Cases 20 and 24).
Results

Patients Admitted in Coma

Five patients (14%) were admitted in a comatose state for their first admission during the study period. Two of them (Cases 4 and 21) had been treated previously with stereotactic aspiration; these patients first received a ventriculostomy. The three patients admitted in a comatose state who had not been treated previously for a colloid cyst (Cases 24, 30, and 31) had complained of headaches for 4 months to 5 years before admission. Two patients (6%: Cases 30 and 31) were thought to have viral meningitis when seen by the referring physician. Both patients deteriorated following lumbar puncture performed at the referring center and later died. The patients in Cases 4 and 24 made excellent recoveries after two procedures each (Table 1). The patient in Case 21 improved in consciousness when receiving ventricular drainage, but remained disabled following an attempt at aspiration and microsurgical total removal. He underwent shunt placement without any additional improvement.

Patients Receiving Radiological Follow Up Without Treatment

Seven patients received radiological follow up only for 6 to 37 months after diagnosis (Table 2). Their cysts were incidental findings or caused minimal symptoms. The cysts in a majority of these patients showed slow growth. Four patients became symptomatic or experienced an increased intensity of their symptoms. These four patients underwent operations after receiving follow-up care for 6 to 37 months.

Cases 34, 35, and 36 were never treated surgically. The patient in Case 34 was 78 years old with a dementia and was being examined for hemiparesis. The colloid cyst was an incidental finding on a CT scan demonstrating a large infarction. The patient received follow-up care for 2 years without progression. The patient in Case 35 was 59 years old and was being examined for a large left parietal infarction. He refused surgery and 3-year follow-up review shows increased cyst size & ventricular widening. After 9 years episodes of headache & personality disturbance. Refuses new surgery. Excellent outcome.

Table 2

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs)</th>
<th>At Dx (mm)</th>
<th>At Follow Up (mm)</th>
<th>Duration of Follow Up (mos)</th>
<th>Hydrocephalus</th>
<th>Symptoms at Dx/ Follow Up</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>9</td>
<td>high</td>
<td>3</td>
<td>7</td>
<td>NPH</td>
<td>headache/none</td>
</tr>
<tr>
<td>12</td>
<td>73</td>
<td>high</td>
<td>16</td>
<td>18</td>
<td>none</td>
<td>headache/none</td>
</tr>
<tr>
<td>15</td>
<td>56</td>
<td>high</td>
<td>8</td>
<td>8</td>
<td>none</td>
<td>headache/none</td>
</tr>
<tr>
<td>17</td>
<td>36</td>
<td>high</td>
<td>6</td>
<td>8</td>
<td>none</td>
<td>headache/none</td>
</tr>
<tr>
<td>34</td>
<td>78</td>
<td>high</td>
<td>23</td>
<td>11</td>
<td>NPH</td>
<td>none</td>
</tr>
<tr>
<td>35</td>
<td>59</td>
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<td>36</td>
<td>24</td>
<td>high</td>
<td>22</td>
<td>10</td>
<td>NPH</td>
<td>headache/none</td>
</tr>
</tbody>
</table>

‡ No symptoms initially, but developed NPH and confusion 3 to 4 months before treatment.

† Ventricular size did not change significantly during the follow-up interval except for the patient in Case 12, who experienced increased hydrocephalus.

Table 3

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Treatment Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>1987: Stereotactic aspiration. Endoscopic guidance. Subtotal evacuation. Patient deteriorated &amp; died from cerebellar infarction. Cerebellar infarction was judged to have caused symptoms &amp; justified hospitalization. Small colloid cyst w/ minimal ventricular widening was probably an incidental finding.</td>
</tr>
</tbody>
</table>
Third ventricle colloid cyst

Aspiration Procedures

The first procedure was a stereotactically guided aspiration in nine patients (Table 3). Four patients (40% of 10 aspirations) had transient memory deficit and one experienced depression following aspiration.

Nine patients demonstrated residual, recurrent, and/or growing cysts at follow-up intervals ranging from 2 days to 9 years. Two patients experienced herniation after 2 days and 5 weeks, respectively and were treated with a good outcome resulting. In this group of eight patients, four underwent microsurgical operations, two underwent another subtotal aspiration, and one refused additional surgery. One patient died from an apparently unrelated cerebellar infarction 2 days after a subtotal stereotactic aspiration of the cyst.

There was no significant difference in outcome between patients treated with or without endoscopic guidance. However, one patient who was treated with endoscopic guidance has been followed for 5 years without a recurrence.

Microsurgical Removal

Twenty-three patients underwent 24 operations performed by four surgeons. The transcaldosal route was used for 22 operations and the transfrontal for two. One patient (Case 4) underwent two exploratory operations, with removal of a choroid plexus cyst in 1987, and a true colloid cyst in 1990.

Neurological deterioration (transient confusion and/or transient memory deficit, normalization within 1 week) was detected in six patients (26%: Cases 1, 7, 13, 14, 20, and 22). One patient (Case 1) had transient mutism for 1 week postsurgery. Postoperative transient memory deficit appeared to correlate with moderate surgical trauma to the ipsilateral fornix. Cyst removal required interforniceal dissection in Case 1. In six patients (Cases 5, 7, 13, 14, 20, and 22), the cysts were removed in toto through the foramen of Monro, thereby distending the ipsilateral fornix. A retractor was placed adjacent to the fornix, causing some fornical bruising in the patient in Case 6. In the remaining 16 operations among 15 patients, the cyst was removed piecemeal through the foramen of Monro, avoiding fornical injury. Microsurgical removal was radical, including the entire capsule in all operations except the first operation in Case 4 and the operation in Case 6. The latter patient had a cyst growing between the roof and the choroid plexus of the third ventricle. A part of the capsule that was largely adherent to the internal cerebral veins was left. The cyst in Case 18 was also growing between the roof and the choroid plexus of the third ventricle.

Postoperative Complications

Two patients with scarring of the operative fields due to previous aspiration procedures had bone flap infections. Another patient with an unfavorable outcome (Case 21) was in poor condition before microsurgical cyst removal. He suffered visual, mental, and memory impairment caused by preoperative herniation and a very large cyst.

The 24 operations performed by four surgeons had a 10% infection rate and a 29% rate of transient memory deficit. There was no mortality or permanent morbidity caused by surgery, but two patients failed to improve to GOS score 5 following preoperative coma.

Two of the seven patients operated on one patient each. One of these patients died 10 days after surgery from a central brain infarction caused by atrial fibrillation or venous infarction (GOS score 1). The other patient displayed a permanent memory deficit at follow-up review at 6 months and 3 years, but was able to care for himself (GOS score 4). His cyst was removed in toto through the foramen of Monro.

Forniceal Trauma During Microsurgery

The possible influence of fornical trauma during microsurgery was evaluated. The 15 patients (16 operations) with piecemeal removal and no other known surgical fornical trauma were compared with the remaining eight patients. Altogether, removing a cyst in toto through the foramen, traumatizing a fornix with the retractor, or interforniceal dissection of a large cyst were recorded in all seven patients with postoperative memory deterioration. Perioperative fornical traumatization was detected in one of 17 patients without memory deterioration (p < 0.001, Fisher’s exact test).

Discussion

The data presented come from an unselected consecutive series of patients with colloid cysts managed at our institution during the last 12 years. This series provides information to update our understanding of colloid cysts and enables comparison of two treatment modalities with different degrees of invasiveness: aspiration with or without endoscopic control and microsurgical removal.

Epidemiological Findings

The sex difference noted (70% males) agrees with the male predominance observed by Nitta and Symon. Camacho, et al. found no sex difference in a series from the Mayo Clinic. However, their cases may have reflected referral patterns and may have been more selected. Our series consists of patients from a fixed geographical area and is therefore more likely to be a random sample. The preoperative syndromes of headache or NPH have been described previously. In the present series, younger patients were more likely to be examined for headaches or an isolated memory deficit, whereas the patients presenting with NPH symptoms were older. Eight percent of the patients were younger than 15 years of age, thus contradicting the belief that these lesions are particularly rare in children.

This series contains anecdotal reports of two curious findings. The patients in Cases 8 and 31 were mother and son. Two previous cases of colloid cysts in twins and non-twin brothers have been reported. To our knowledge, this is the first report of colloid cysts in a mother and son, adding to the literature a case in which inherited genetic defects may have caused the cysts. The other unusual finding was in the patient in Case 26. He had symptoms of headaches and a memory deficit for 2 weeks until sudden deterioration from a hemorrhage in the cyst; to our knowledge, this is the only case of colloid cyst apoplexy reported.
Risk of Sudden Deterioration

This series shows that colloid cysts still carry a risk of death and that coma is a fairly common presenting condition. The five comatose patients in our series had symptoms of increased ICP for a considerable time before developing signs of impaired consciousness. They had sought medical attention but without receiving the correct diagnosis. Delay in treatment was the most important avoidable factor of morbidity and death in this series. The two patients who died were admitted in a comatose state after lumbar puncture.

Increased vigilance in the workup of these patients might be indicated. The lesions are rare, but potentially dangerous. The mean time from onset of symptoms (3 months in recurrences, 14 months in new cases) to diagnosis in this series was shorter than the 29 months reported by Camacho, et al. The interval between onset of symptoms and treatment still appears to be too long, especially considering that a large number of patients were treated for recurrent cysts. The delay in detection of recurrent cysts probably reflected negligence of the risk. Microsurgery and aspiration both carry such risks if incomplete. It is a common practice to leave the capsule rather than risk neurological damage. In addition, a normal postoperative CT or magnetic resonance (MR) image does not rule out the possibility that vital epithelium might remain in the third ventricle. Patients should therefore be advised to seek medical attention if symptoms recur. It is possible that radiological follow-up studies may also be advisable in the late phase.

Incidental Cysts

Improved diagnostic tests and widened indications for CT and MR studies will increase the number of incidentally found lesions. Whether all cysts grow to become symptomatic is an open question that can only be answered with prospective studies of incidental colloid cysts. The data indicate that a majority of colloid cysts progress, albeit slowly. Sudden deterioration followed by death has not been reported with colloid cysts less than 1 cm in size investigated previously or in the present series. Patients deteriorating rapidly have usually been symptomatic for a considerable time and always for more than 2 days before deterioration as reported by other investigators as well as in the present series. Very small cysts with minimal signs of cerebrospinal fluid flow obstruction can thus probably be followed up without treatment for a considerable time without undue risk if the patients are informed of when to seek emergency medical treatment.

The ventricular widening was either restricted to the lateral ventricles, as would be expected from an obstacle to cerebrospinal fluid flow in the anterior third ventricle, or was general with a widened third ventricle as in NPH. The three patients with general ventricular widening and incidentally found cysts apparently received little benefit from cyst surgery or were not treated and did not deteriorate during the follow-up interval. It is likely that the risks of deterioration are smaller in patients with general ventricular widening.

The risks and benefits of surgery depend on the patient’s condition and the surgeon’s experience and will have to be judged individually for each patient. Treating these lesions expectantly will probably not cause a high immediate risk of deterioration if the patient is reliable and well-informed. However, our results corroborate those of Macdonald, et al., who believe that younger patients will become symptomatic during their lifetime and thus need surgery.

Minimally Invasive Treatment for Colloid Cysts

We have previously reported a high rate of initial surgical failures and late recurrences after aspiration. This study includes several patients not previously reported and agrees with our earlier findings. The comparison of aspiration with microsurgical removal of cysts brings another interesting factor into focus. The risk of transient confusion/memory deficit was lower after microsurgery than after the seemingly less invasive procedure of aspiration. The manipulation necessary to perforate the cyst capsule with the needle and the trauma caused by aspiration appeared to cause damage of a similar or higher magnitude than in microsurgical dissection. Figure 2 shows minimal damage to the nervous system following transcaldos surgery.

Most of the aspiration procedures were performed under endoscopic control, which did not improve short- or long-term results in our series or in earlier reports. However, these patients were not treated with the newest endoscopic techniques. Technical developments will
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probably improve the results of endoscopic approaches. Several authors have reported good results with minimally invasive endoscopic techniques.7,14,15,28 The term “minimally invasive” can, however, be deceptive. A small bone defect and a stereotactically guided transcortical approach to the foramen of Monro appear to be minimally invasive, but did not minimize neurological damage in this series. In addition, transcortical surgery for colloid cyst removal or shunt placement carries a 5% risk of postoperative neurological damage in this series.17,18

Another open question is, how radical must surgery be? It is clear that partial aspiration of a cyst is unacceptable.31 Caemart and Calliau7 and Deinsberger and colleagues advocate removal of the cyst contents and opening the cyst widely to allow any reproduced colloid to be washed out into the ventricular system. We also left some of the cyst capsule behind in two patients. It could be speculated that a continuous leak of colloid may cause inflammatory changes or hydrocephalus. Determination of whether these low amounts of colloid are harmful and whether any degree of subtotal removal is compatible with negligible recurrence rates awaits a follow-up interval of at least 10 to 20 years.

Microsurgery and Memory Impairment From Forniceal Traction

Microsurgical results have been reported by previous authors.1,2,9,12,17,36 In modern series, low morbidity and mortality rates were achieved with transcortical surgery. Although transcortical surgery is usually referred to as the treatment of choice,2,9,10 only small numbers of transcortical colloid cyst operations have been reported in different series.7,9,11,12,41

Limited callosal sectioning may cause changes in transfer of tactile data that can be detected with special neuropsychological testing, but this does not seem to cause any deficit that can be noticed by the patients in normal life.4,27 In previous reports, however, transcortical surgery for colloid cyst has produced significant morbidity. Permanent memory deficit and/ or venous infarction were reported in 24% of patients. The complications were caused by tampering with the central veins and fornices in the third ventricle area or sacrificing frontal bridging veins. Transient memory deficit and postoperative death from unknown causes have been reported in additional patients. In our series, similar complications occurred in the two patients treated by surgeons having less experience with the procedure. This series also shows that excellent results can be achieved with transcallosal surgery, provided that the operation is performed by a limited number of surgeons who have sufficient experience with the procedure. The most common complaint following microsurgical approaches was transient memory deficit and/or confusion, which normalized within 1 week. The common factor for patients experiencing this kind of morbidity appeared to be mild surgical trauma to the ipsilateral fornix. Although it cannot be proven that distention of a fornix during cyst removal in toto actually caused fornical damage, the correlation between surgical tactics and transient memory deficit is striking and seems to be coherently explained by the assumption of unilateral fornical damage.

The role of the fornix in memory functions has been debated.4,22 Early reports even advocated elective sectioning of one fornix to improve the surgical field.8,16,20 These investigators denied any important influence of one fornix on short-term memory, provided that the other was left intact. Modern investigators take a more cautious view regarding fornical damage, reporting a significant risk of permanent memory disturbance.10,11,18,22 It is possible that the improved microsurgical results have enabled investigators to detect milder sequelae. The authors favoring fornical sectioning published their papers before 1975, whereas the majority of researchers warning against sectioning of the fornices have published after 1980. The correlation between transient memory deficit and mild fornical injury in our patients offers further circumstantial evidence toward assigning both fornices central roles in short-term memory. The surgical implication is that manipulation and traction of the fornices must be minimized. Piecemeal removal or gentle aspiration of the cyst contents is preferable whenever possible.

Conclusions

A colloid cyst of the foramen of Monro is a condition that should be detected before permanent neurological damage has occurred. The natural course of incidentally found cysts is not well known, but most available data suggest a slow progression of cyst growth. If surgery is undertaken, transcallosal microsurgery is a good treatment option, with negligible morbidity and mortality rates. Permanent morbidity or mortality should not be accepted as an outcome in modern series of colloid cysts of the third ventricle. In this series both long- and short-term results were better with transcallosal microsurgery performed by experienced surgeons than with the seemingly less invasive aspiration procedures using stereotactic guidance and endoscopic control.

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