Surgical resection of third ventricle colloid cysts

Preliminary results comparing transcallosal microsurgery with endoscopy

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It is still not determined which is the best surgical option for third ventricle colloid cysts. Since 1990, the authors have used a steerable fibrescope to remove colloid cysts in seven patients and have performed microsurgery via a transcallosal approach in eight patients. The two techniques were compared for operating time, length of hospital stay, incidence of complications, recurrence, and hydrocephalus, and days spent recuperating before return to work to determine if endoscopic removal of colloid cysts is a safe and effective alternative to microsurgery. Statistical analysis was adjusted for age, sex, and presenting symptoms.

Microsurgical cases averaged 206 minutes of operating time whereas endoscopic cases averaged 127 minutes (p = 0.01). For combined days spent in the intensive care unit and on the ward, the patients averaged 9.5 days after microsurgery and 4 days after endoscopy (p = 0.05). Postoperative complications occurred in five of eight patients after microsurgery and in one of seven patients after endoscopy (p = 0.09); complications were transient and primarily related to short-term memory loss. In all patients, preoperative symptoms resolved and the cysts have not recurred. Postoperatively, one patient required a ventriculoperitoneal shunt after microsurgery but all patients were shunt-independent after endoscopy. Patients returned to work an average of 59 days after discharge following microsurgery compared with an average of 26 days after endoscopy (p = 0.05). Compared with transcallosal microsurgery for the removal of colloid cysts, these preliminary results show that a steerable endoscope reduced operating time and that patients spent fewer days in the hospital and returned to work sooner after endoscopy.

Key Words • colloid cyst • endoscopy • third ventricle • laser • transcallosal approach

Colloid cysts are benign intraventricular tumors that arise primarily from the roof of the third ventricle and may produce sudden death due to acute obstruction of cerebrospinal fluid (CSF) pathways. Most patients present with headaches due to raised intracranial pressure and hydrocephalus. Associated symptoms include short-term memory loss, nausea and vomiting, blurred vision, emotional lability, and gait disturbances.

Present management options for colloid cysts include observation, shunting of CSF, stereotactic cyst aspiration, transcortical-transventricular microsurgery, transcallosal microsurgery, and now endoscopic surgery. Improvements in fiberoptic technology and instrumentation and increased surgical experience have led to further applications of endoscopy in neurosurgery. Since 1990, we have used a steerable fibrescope to remove colloid cysts in seven patients and have performed microsurgery via a transcallosal approach in eight patients. We compared the two techniques for operating time, days spent in the intensive care unit (ICU) and on the ward, incidence of complications, recurrence, and hydrocephalus, and length of time before return to work to determine if endoscopic removal of colloid cysts is a safe and effective alternative to microsurgery.

Clinical Material and Methods

Patient Population

From April, 1990, to June, 1993, 19 consecutive patients with colloid cysts were evaluated at our insti-
Endoscopic resection of colloid cysts

Patients who underwent endoscopy included five males and two females ranging in age from 14 to 57 years (mean 40 years). Patients undergoing microsurgery included four men and four women ranging in age from 21 to 69 years (mean 39 years). Presenting symptoms were similar for both groups; headache was the most common complaint (14 patients), followed by nausea in four, vertigo in three, blurred vision in three, short-term memory loss in two, photophobia in two, and emotional lability in one. One case presented as an incidental finding on computerized tomography (CT) after a routine scan for a meningioma that had been followed for 7 years. Only one patient reported the onset of headaches with changing head position.

Endoscopic Technique

After general endotracheal anesthesia is administered, the patient is placed supine with the head supported by a cerebellar head holder in a neutral position and the thorax elevated 15°. A linear skin incision is made parallel to the coronal suture and centered over a burr hole 5 cm lateral to the midline and 1 cm in front of the coronal suture. The burr hole is created with a high-speed drill and beveled laterally to allow enough angulation of the endoscope to reach the contralateral ventricle. The dura is incised and the ventricle cannulated with a No. 14 French peel-away sheath and stylet. After withdrawal of the stylet, a 4-mm steerable fiberscope* with a 1-mm diameter working channel is inserted into the ventricle. We use a potassium titanyl phosphate (KTP) 600-µm laser fiber† to open the cyst cavity and coagulate the vascular outer layer of the cyst wall. Laser power is set to 3 to 5 W of continuous energy. Pulsed irrigation with lactated Ringer’s solution is used to maintain a fluid interface and cool the CSF. A 1-mm forceps is used to remove the colloid material and cyst wall, after which the introducer is withdrawn and a piece of Gelfoam is placed over the dura. A circular metal cover is plated over the burr hole for cosmetic purposes.

Data Analysis

All hospital and office medical charts were reviewed and patients were interviewed in person or by telephone. Operating time was measured from initial incision to the end of skin closure. Days spent in the ICU were calculated from the day of surgery to the day of transfer to the ward. Days spent on the ward were calculated from the day of transfer out of the ICU until the day of discharge. The dates of return to work were obtained from each patient and confirmed by medical chart records or employers. Statistical analysis was performed using the chi-squared test and Fisher’s exact test. All calculations were adjusted statistically for age, sex, and presenting symptoms.

Results

Operating Time

Colloid cysts resected with an endoscope required less operating time than microsurgical cases (p = 0.01). Operating time for microsurgical cases ranged from 157 to 257 minutes (mean 206 minutes) and for endoscopic cases from 80 to 180 minutes (mean 127 minutes). As we gained more experience with the endoscope, the time required to remove a colloid cyst dropped from an average of 168 minutes for the first three cases to 96 minutes for the last four cases.

Hospital Stay

Patients who underwent endoscopic resection of a colloid cyst spent fewer days in the hospital than did patients who underwent microsurgery (p = 0.05). For microsurgical cases, the patients spent 1 to 7 days (mean 3.5 days) in the ICU. The first patient treated by endoscopy spent 5 days in the ICU due to confusion and lethargy; thereafter, each patient spent 1 day in the ICU (mean 1.7 days). Time spent on the ward ranged from 2 to 16 days (mean 6 days) for microsurgical cases and from 1 to 3 days (mean 2.4 days) for endoscopic cases.

Complications

Although patients as a group suffered more complications after microsurgery than after endoscopy, the difference was not significant (p = 0.09). Microsurgical complications occurred in one patient who suf-

* Steerable fiberscope manufactured by Codman and Shurtleff, Inc., Randolph, Massachusetts.

† Laser fiber manufactured by Laserscope, San Jose, California.
ered a right basal ganglion infarction with left hemiparesis and left leg thrombophlebitis that required anticoagulation. Another patient who underwent microsurgical resection developed unilateral hydrocephalus after a gliotic membrane formed over the right foramen of Monro (Fig. 1 left). That patient underwent endoscopic fenestration of the membrane to avoid placing a shunt (Fig. 1 right). In addition, three patients who underwent microsurgery suffered transient short-term memory loss postoperatively.

Complications in both the microsurgical and endoscopic groups were transient. The first patient who underwent endoscopic resection suffered a right basal ganglion infarction with left hemiparesis as well as short-term memory loss. We suspect that using the KTP laser at high power (18 W) within a trapped ventricular air pocket caused thermal injury to the surrounding tissue. Since that time, we have avoided thermal injury by maintaining a fluid interface when the laser is in use and by rarely exceeding 5 W of laser energy. Clinically, preoperative symptoms resolved in all patients and there have been no radiological or clinical recurrences. One patient who underwent microsurgery required a ventriculoperitoneal shunt postoperatively. All patients who underwent endoscopy remained shunt-independent.

Return to Work

All patients returned to work or to their preoperative routine daily activities if they were retired. Patients returned to work sooner after endoscopy (15 to 57 days, mean 26 days) than after microsurgery (21 to 109 days, mean 59 days) (p = 0.05).

Discussion

Currently, management options for colloid cysts include observation, shunting of CSF, stereotactic cyst aspiration, transcortical-transventricular craniotomy, transcallosal craniotomy, and endoscopic surgery. The variety of options reflects the technical difficulty in re-moving these benign lesions with minimal morbidity. The strengths and weaknesses of each approach are discussed below.

Observation or Shunting

Camacho and coworkers advocated observation if the ventricles were small and the cyst measured less than 1.5 cm in diameter. Influenced by our own experience (since 1984) with five patients who died from acute ventricular obstruction, including three with small cysts, we do not recommend observation only for colloid cysts. Shunting as an alternative to surgery has been recommended, but bilateral ventricular catheters may be required if the lateral ventricles do not communicate across the septum pellucidum. In our view, CSF diversion is less satisfactory because the treatment is not curative and shunts are susceptible to malfunction and infection.

Stereotactic Aspiration

In 1978, Bosch and associates first described stereotactic aspiration of colloid cysts. Initial results established that aspiration was a safe and effective treatment alternative to microsurgery; however, long-term results have demonstrated a high recurrence rate with this technique. Further experience revealed that aspiration often failed when the cyst had a thick wall, was less than 1 cm in size, or was highly viscous or solid. In addition, aspiration has the potential for injuring the fornices or producing hemorrhage from ependymal veins. Mathieson, et al., found that four (25%) of 16 recurrent cysts presented with uncal herniation due to acute hydrocephalus and eight (62%) of 13 cases recurred despite more than one aspiration procedure. In all eight cases where aspiration was performed under direct visualization with ventriculoscopy, the cyst recurred. The high recurrence rate following aspiration is not surprising because the wall of the colloid cyst, which secretes the colloid material, is neither excised nor devascularized.

Transcortical-Transventricular Approach

Fritsch used a transcortical-transventricular approach to resect 18 colloid cysts with no ensuing permanent neurological deficits. Unfortunately, six (33%) of 18 cases in that series required permanent ventricular diversion. Morita and Kelly advocated a transcortical craniotomy with computer-assisted volumetric stereotaxis to minimize damage to important cortical and deep structures. In addition to preoperative imaging studies, this technique required the use of a stereotactic head holder and stereoscopic digital subtraction angiography, CT, and MR imaging. Given the additional cost of these imaging studies combined with the expense of the stereotactic system, this technology is unlikely to gain widespread use by the neurosurgical community. Moreover, complications occurred in 10 (33%) of 30 patients with third ventricle lesions (of which 27 were colloid cysts) and included impaired memory in four patients, disturbed consciousness in two, postoperative hydrocephalus in two, syndrome of
Endoscopic resection of colloid cysts

inappropriate antidiuretic hormone secretion in one, and subdural hygroma in one.12

Transcallosal Approach

With widespread use of the operating microscope in the 1970's, the transcallosal approach became the standard treatment for resection of colloid cysts.2 This approach provides natural planes for dissection and anatomical landmarks for orientation, and avoids a cortical incision. Nevertheless, complications of transcallosal surgery such as venous infarction from sacrificing bridging veins, thrombosis of the sagittal sinus from retraction, arterial infarcts from separation of the pericallosal arteries, disconnection syndromes, and damage to the fornices and subcortical nuclei have led investigators to consider alternative approaches.1,3,4,7-13

Endoscopic Approach

Endoscopic treatment of colloid cysts is not new. In 1983, Powell, et al.,13 successfully aspirated anteriorly placed colloid cysts using a rigid endoscope. However, they were unable to visualize posteriorly placed colloid cysts and an open craniotomy was required. In 1988, Auer, et al.,1 reported having aspirated and coagulated a colloid cyst with a neodymium:yttrium-aluminum-garnet laser, but they did not remove it. Using two burr holes and a flexible endoscope, Cohen and Shucart7 successfully excised two colloid cysts and partially removed another. One operation was performed under local anesthesia because the patient had multiple medical problems.

Advances in fiberoptics coupled with the development of endoscopic tools that can perform dissection, biopsy, and coagulation have expanded the role of endoscopy in neurosurgery. There are several advantages to using an endoscope for removal of colloid cysts. First, positioning is simple as the patient is placed in a neutral supine position with the thorax elevated 15°. Second, the incision and burr hole follow the landmarks for a standard right frontal ventriculostomy. Third, a straight incision and single burr hole provide rapid access to the cyst. Fourth, the endoscope is placed through an introducer slightly larger than a ventricular catheter, so there is minimal disruption of the cortex. Finally, stereotactic cannulation of the ventricles is not required and the procedure can be performed under local anesthesia.

After performing more than 400 endoscopic procedures (including resection of seven colloid cysts), we have learned several important lessons regarding preoperative imaging, neuroanatomy, and endoscopic technique. Magnetic resonance imaging is an essential diagnostic tool to determine the position of the colloid cyst within the third ventricle and its relationship to the ependymal veins (Fig. 2). The optimal trajectory is achieved when the fiberscope enters through the largest part of the lateral ventricle and the tip rests at the base of the cyst. Internal cerebral veins placed laterally to the colloid cyst may make a complete resection very difficult. Posteriorly placed colloid cysts may not be visualized through the ipsilateral foramen of Monro. Irrigation through the contralateral foramen of Monro forces the colloid cyst into view for resection through the ipsilateral foramen of Monro. When the foramen of Monro is small, the choroid plexus may obscure the colloid cyst. In such situations, the choroid plexus is coagulated with the laser and removed with forceps. As the cyst is decompressed, the area in which to maneuver the fiberscope increases and extirpation becomes easier (Fig. 3). Although we have not observed any regrowth of colloid cysts, we suspect that, like ventricular cysts, they must be devascularized with the laser to prevent recurrence. To avoid thermal injury, the laser is used only within a fluid interface and maximum energy rarely exceeds 5 W. Concomitant pulsed irrigation reduces the risk of thermal injury.

Some investigators have expressed concern that ventriculitis may result from spillage of colloid material within the ventricular system,7 but this did not occur in our series. Postoperative seizures may develop after a transcortical approach,10,12 but none of our endoscopic patients suffered seizures postoperatively and
phylactic anticonvulsant agents had not been prescribed in any case. Although seizures may still develop, operating through an introducer slightly larger than a ventricular catheter in a relatively nonloquent area of the brain should produce a very low incidence of postoperative seizures.

Initially, we used intraoperative ultrasonography, fenestrated the septum pellucidum, and placed an external ventricular drain as part of each endoscopic procedure. With increasing experience, we have relied on ultrasonography only for cannulating small ventricles. We no longer fenestrate the septum pellucidum or place external ventricular drains. These changes have resulted in decreased operating time, from an average of 168 minutes for the first three procedures to an average of 96 minutes for the last four.

Conclusions

Preliminary results of endoscopic removal of colloid cysts are encouraging. As we gained experience with this technique, the last four patients averaged 96 minutes of operating time, 1 day in the ICU, 1 day on the ward, and a return to work 22 days after discharge. Fortunately, no complications have occurred since the first case. Nevertheless, a larger group of endoscopically treated patients with a long follow-up period is necessary to fully assess the use of the endoscope for removal of colloid cysts.

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References


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