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Endoscopic Approach to Colloid Cysts

Abstract

Objective: The aim of this study is to discuss the variations in the morbid anatomy of colloid cysts with its impact on the choice of endoscopic approach through a standard Kocher's burr hole. **Methods:** This study was conducted on 18 patients between 1996 and 2006. All patients were operated through a single burr hole at Kocher's point using a rigid endoscope with a single working channel. The anatomical variations of the cyst and the foramen of Monro dictated the use of the transforaminal approach, the transeptal interforaminal approach or both. **Results:** There were no mortalities or significant morbidities. The operative time ranged between 90 to 240 minutes (with a mean of 110 minutes). Five patients (27.7%) developed remediable postoperative chemical meningitis successfully controlled with steroids. Postoperative transient memory disturbance was observed in 3 patients (16.7%). One patient had a postoperative CSF leak that stopped spontaneously. Aspiration of the cyst's contents showed variable degrees of resistance to aspiration. The period of follow-up ranged between 5 months to 8 years and 3 months (mean: 4 years and 2 months). None of our patients showed radiological evidence of cyst recurrence during the follow-up period. **Conclusion:** Through a single right pre-coronal burr hole at Kocher's point, several endoscopic manoeuvres can be done. These include aspiration of the contents or its piece-meal removal, combined balloon squeeze and aspiration, foraminoplasty, pellucidotomy, coagulation of cyst capsule and ETV. The choice of the appropriate approach is largely dependent on the location of the cyst and the shape of the foramen of Monro. Coronal MRI may aid in preoperative evaluation of the tucked up retroforaminal growth of the cyst. We had no recurrence in our

series with a follow-up reaching more than 8 years. This could be attributed to both the marsupialization and coagulation done for the remaining cyst capsule.

Key words

Neuroendoscopy · colloid cysts · transforaminal approach · transeptal interforaminal approach

Introduction

Third ventricular colloid cysts constitute about 0.5 to 1% of all intracranial tumors [1–3]. Surgery of this benign cystic lesion has challenged neurosurgeons since Dandy successfully removed a colloid cyst in 1921 [4]. Several therapeutic options have been proposed, ranging from shunting [5] to stereotactic aspiration [6–8]. In the past decade, microsurgical resection with the use of either a transcalsal [9–11] or a transcortical-transventricular [9,12,13] approach has been accepted as the “gold standard” treatment of colloid cysts. As this cystic lesion commonly induces obstructive hydrocephalus it is considered an attractive target for neuroendoscopic intervention. This has been supported in the past decade with the rapid advancement of neuroendoscopic equipment making endoscopic resection an effective, generally safe procedure with a favourable outcome [14–26]. The aim of this study is to discuss the impact of the variations in the morbid anatomy of colloid cysts on the choice of the endoscopic approach.

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Patients and Methods

Patients

This study was conducted on 18 patients (10 males) treated in the University Hospitals of Kasr El Aini School of Medicine, Cairo and Tanta University Hospital, Tanta, between 1996 and 2006. The age ranged between 14 and 60 years (mean: 33.6) with the clinical presentations shown in Table 1.

Endoscopic equipment

The rigid endoscope with a single working channel was used in all cases. The French 3 Fogarty catheter – whenever needed beside the instrument in the working channel - was inserted through the irrigation channel. The excess and outflow of the irrigation sufficiently welled out from around the catheter and the instrument.

Operative technique

Under general endotracheal anesthesia, in the supine position, a precoronal 1.5 cm. burr hole was done 3 cm lateral to the midline and jutting with the coronal suture. All the patients had moder-

ate to severe hydrocephalus, hence free-hand insertion of the trocar followed by intraventricular endoscope loading was always done without any difficulty.

After careful endoscopic inspection of the anatomic structures and landmarks around the foramen of Monro, their relation to the colloid cyst was defined and the appropriate endoscopic approach chosen. These variations are shown in Fig. 1 and Table 2.

The shape and size of the foramen of Monro dictated the use of the transforaminal approach (in 7 cases), the transeptal interforaminal approach (in 4 cases) and the combined approach (in 7 cases). Foraminoplasty was done in 10 patients who had a crescentic, coapted, displayed and glued foramina. Fogarty balloon squeeze of the cyst contents to facilitate its aspiration was done in 7 cases (Fig. 2).

The transforaminal approach

We started the resection with initial bipolar coagulation of the cyst capsule and the overlying choroid plexus followed by fenestration of the cyst capsule. The contents of the cyst varied from mucoid suckable to solid difficult to aspirate and even mixed contents. A central venous cannula (CVC) was inserted and suction of the contents attempted. We initially used a 10-mL syringe followed by a 20-mL syringe if a forcible suction was required for the thick mucoid contents. Piecemeal removal of the solid contents with the biopsy forceps was done. Following evacuation of all the cyst contents, bipolar shrinkage of the inner and outer surfaces of the cyst capsule facilitated its maximum possible resection.

The transeptal-interforaminal approach

The cyst was approached through the septum pellucidum just behind the anterior septal vein. Initial coagulation and fenestration of the septum and underlying cyst capsule was performed. Using CVC, aspiration of the contents was first attempted apply-

Table 1 Clinical presentations

Clinical Features	No. of Patients
Headache	17
Vomiting	2
Ataxia	2
Papilledema	13
Post-papilledemic optic atrophy	2
Urinary incontinence	5
Memory disturbance	3
Decreased level of consciousness	6
Bobble head doll syndrome	1

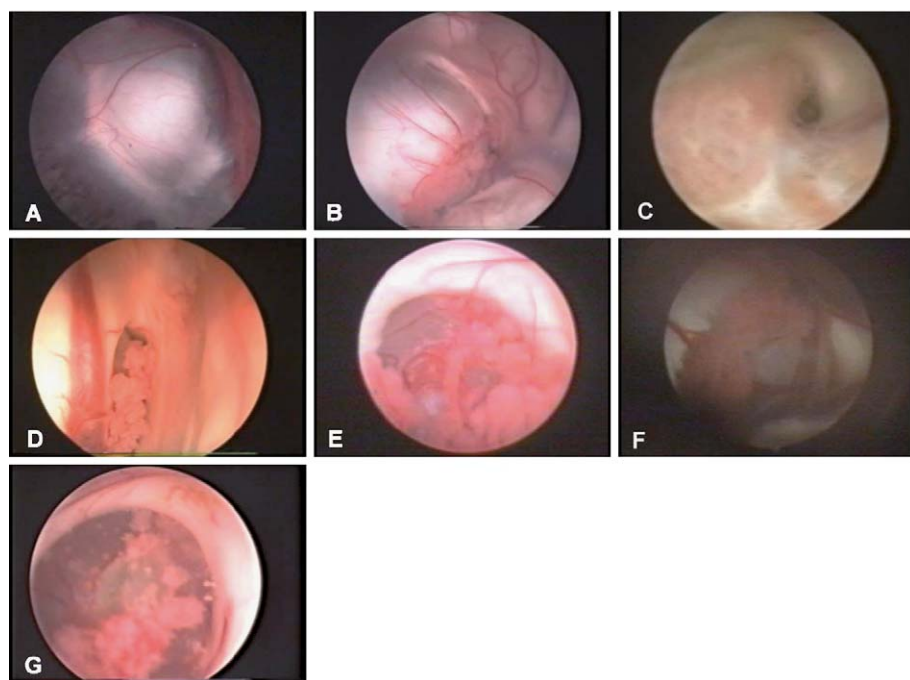


Fig. 1 Endoscopic morbid anatomical variations showing the relationship of the colloid cysts to the foramen of Monro and related structures. The foramen of Monro is A "displayed", B "coapted", C "glued", D "crescentic", E "large" having enough space but with little choice of target area, F "divaricated" with the anterior septal vein running on cyst capsule, and G "dilated" permitting multiple points of entry.

Table 2 Types of foramina

Types of Foramina	No. of Patients
Displayed	2
Coapted	4
Glued	1
Crescentic	3
Large	4
Divaricated	1
Dilated	3
Total	18

Table 3 Size of cysts

Size of cyst in cm	No. of Patients
< 1,5	5
1,5–3	8
>3	5

Table 4 Endoscopic approaches

Approach	No. of Patients	Shapes of foramina encountered
Transforaminal	7	1 divaricated, 3 dilated, 3 large
Trans-septal interforaminal	4	3 coapted, 1 glued
Combined	7	3 crescentic, 1 large, 1 coapted, 2 displayed

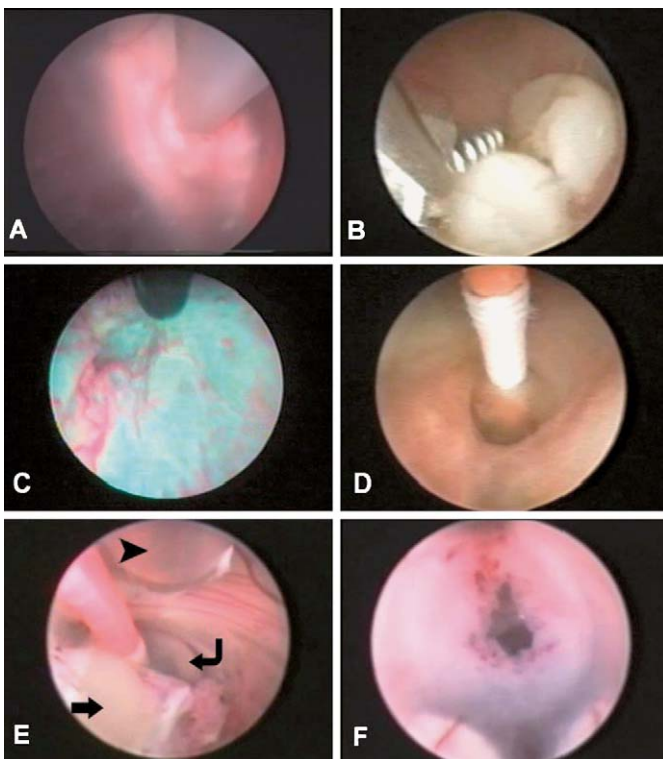


Fig. 2 **A** Aspiration of the cyst contents. **B** Removal of the solid contents with the biopsy forceps. **C** Cauterization of the inner surface of the capsule. **D** Balloon foraminoplasty of the amalgamated foramen. **E** Combined balloon squeeze and aspiration of contents. Note: the suction catheter (arrowhead), the inflated balloon catheter in the foramen of Monro (angled arrow) and the squeezed out contents (straight arrow). **F** ETV.

ing the same principle as mentioned above. A French 3 Fogarty catheter was then inflated around the fenestration to dilate it allowing better access to the remaining cyst contents. Balloon foraminoplasty was always performed to restore a patent foramen of Monro and squeeze the remaining cyst contents to facilitate removal with a suction catheter or a biopsy forceps.

The combined approach

Starting with the transforaminal approach, it would be possible to access the cyst capsule directly and deal with the contents. The bulging part behind the septum pellucidum is then approached through the transseptal-interforaminal approach.

We performed third ventriculocisternostomy as a last step in all of the cases. This was to ensure patency, free CSF circulation and prevent an unexpected rise in the intracranial pressure due to impaction of tissue debris or solid cyst fragments. Only in one patient, with a crescentic foramen of Monro, was a pellucidotomy done to inspect the contralateral foramen of Monro. Bleeding, although not frequently encountered, was controlled by profuse irrigation, Fogarty balloon tamponade and bipolar coagulation as a last resort (2 cases).

Results

In this series we successfully treated 18 patients with colloid cysts without any mortality or significant morbidity. None of our patients had any postoperative deterioration. The preoperative clinical manifestations improved postoperatively. The patients with preoperative decreased levels of consciousness (GCS 13 14), cleared up gradually.

The operative time ranged between 90 to 240 minutes (mean: 133 minutes). With the increase in learning curve the time needed accordingly decreased. Five patients (27.7%) developed remediable postoperative chemical meningitis that was successfully controlled with steroids. Postoperative transient memory disturbance was observed in 3 patients (16.7%). One patient had a postoperative CSF leak, with spontaneous cure 5 days later. The size of the cysts and the distribution of cases according to the approach used are shown in Tables 3 and 4, respectively.

The contents of the cysts showed variable degrees of resistance to aspiration. One patient had a cyst content that was totally solid. Nine patients had mixed contents of thick mucoid that was difficult to aspirate and solid contents that were essentially removed with the biopsy forceps. Most of the previously mentioned ten patients with difficult aspiration had hypointense

lesions on T₂ MR imaging (9 out of 10 patients) (Figs. 3 and 4). The period of follow-up ranged between 5 months to 8 years and 3 months (mean: 4 years and 2 months). None of our patients showed radiological evidence of any cyst recurrence during the follow-up period.

Discussion

The endoscopic approach to colloid cysts started in 1983 when Paul et al. [27] reported their successful endoscopic aspiration of a colloid cyst. Due to the advances achieved in endoscopic equipment and the experience of endoscopic neurosurgeons, endoscopic resection should be considered as the operative approach of choice.

In this study we are presenting different patterns of growth of colloid cysts seen on endoscopic navigation during cyst resection. These patterns of growth are not just typical for all cases. The velum interpositum appears to be the anatomic site of origin of third ventricular colloid cysts [28]. If the cyst slowly grows anteriorly, it tends to widen the foramen of Monro resulting in a foramen that is larger than normal with less choice of target area, a markedly dilated or divaricated foramen with a part of the cyst wall bulging into the lateral ventricle. The direct transforaminal approach was the preferred operative choice applied for these cases.

The cyst may grow posteriorly in the third ventricle medial to the septum pellucidum. This may compromise the foramen of Monro resulting in a coapted or glued foramen. This pattern of growth may also induce a displayed foramen that is hardly seen

with narrowing of the anterior lateral ventricle. For all of these varieties, we essentially opened the septum pellucidum to get access to the cyst as a part of the transeptal interforaminal approach used.

An intermediate type of growth both medial to and bulging through the foramen of Monro gives it a crescent shape. We combined the mentioned approaches whenever any residue of the cyst remained.

Most authors presented their experience in endoscopic colloid cyst resection via a transforaminal approach. We reviewed the literature for reported cases in which the cyst was not visible through the foramen of Monro and how they were managed.

Abdou and Cohen [15] in their series on 13 patients had three patients with posteriorly placed lesions that were tucked up underneath the roof of the third ventricle; they described these cysts to be more difficult to evacuate endoscopically.

Decq et al. [19] and King WA et al. [24] described colloid cysts that were implanted too posteriorly. They believed that such cysts are not easily treatable endoscopically because a rigid endoscope is not physically able to reach a target behind the level of the interthalamic commissure without creating some damage to the foramen of Monro or the fornix.

Rodziewicz et al. [25] clearly mentioned that occasionally colloid cysts do not present at the foramen of Monro. In these cases, the cyst usually protrudes superiorly and splits the septum pellucidum. Such cysts can be approached transventricularly, but sur-

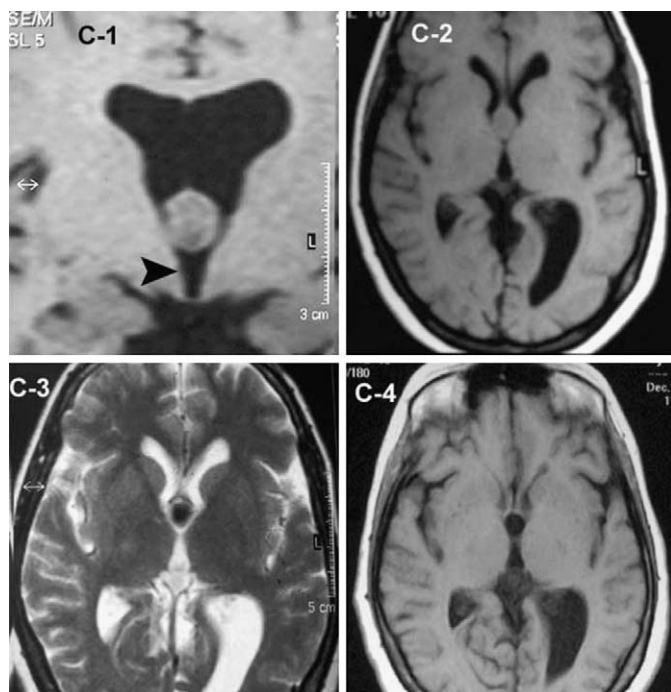


Fig. 3 A retroforaminal tucked up colloid cyst with a normal sized third ventricle in C-1 image (arrowhead). C-2 and C-3 are preoperative axial T₁ and T₂ images respectively. Note: the hypointense lesion on image C-3 (T₂) associated with intraoperative solid cyst contents. C-4 is a postoperative axial T₁ image.

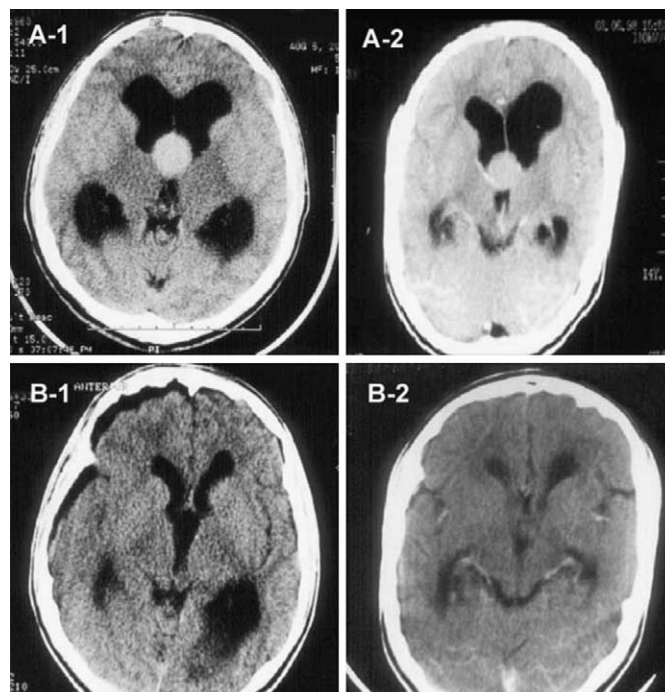


Fig. 4 A-1 and A-2 are preoperative CT scans of patients with coapted and displayed foramina of Monro. Both cysts lie higher than the third ventricle which is filled with CSF behind the lesion. B-1 and B-2 are their respective postoperative scans following resection through the transeptal interforaminal approach.

geons should anticipate the need to open the septum pellucidum to identify and reach the cyst, as in 7 cases of our series.

Vialogo [29] reported a case of colloid cyst located in a retroforaminal position, in the diencephalic roof, dissecting the raphe fornix, expanding superoposteriorly, inside the cavum of the septum pellucidum, and protruding on the floor of lateral ventricles. The cyst was approached with a rigid neuroendoscope, through a precoronal burr hole, 2.5 cm lateral to the midline (Kocher's point). Following a transventricular route, the right leaf of the septum pellucidum was endoscopically opened with bipolar, posterior to the septal vein. The two fornices were split apart by the uncommon expansion and location of the lesion, allowing a new endoscopic transventricular transseptointerforaminal approach. He also performed endoscopic septostomy and third ventriculostomy.

In our study of 18 patients we reported variations regarding visibility of the cyst at the foramen of Monro. The cyst was directly seen filling and widening the foramen of Monro in 8 cases, approached through a direct transforaminal route. Only three cases with crescentic foramina had both a small visible part of the cyst wall at the foramen of Monro and a retroforaminal bulge. In 7 patients we had a totally occluded foramen of Monro with no visible part of the cyst wall but a retroforaminal bulge pointing to the interseptal posteriorly tucked up lesion for which a transforaminal route was not feasible. We essentially opened the septum pellucidum as a part of the transseptal-interforaminal approach.

We believe that the transforaminal route is not the only approach to be used in endoscopic colloid cyst resection. The tucked up growth of the cyst in the posterior third ventricle can markedly approximate the edges of the foramen of Monro making a direct transforaminal route impossible. This direction of growth displaces the fornices, the leaves of the septum pellucidum and widens the interforaminal space. In this situation, the choice should not be to shift to open surgery as the interforaminal approach originally described in transcallosal microsurgery is still feasible with the endoscope.

The evacuation of the contents of the cyst behind the foramen of Monro will open it allowing a transforaminal approach to any remaining parts of the cyst. A combined approach should also be born in mind after transforaminal evacuation if any remnants of the cyst are still seen bulging behind the foramen of Monro and medial to the septum pellucidum.

Short-term memory disturbance due to forniceal trauma is a major disincentive to the transcallosal interforaminal approach to third ventricular lesions. A transient short-term memory loss was reported in 30% of patients in the series of Apuzzo and Amar using the interforaminal approach. The memory disturbance was maximal for the first 24 to 72 h and gradually settled, 75% resolved over 7 days and all resolved or returned to the preoperative status by 3 months [30].

We reported postoperative transient memory disturbances in 3 patients who gradually improved within 3 weeks. Two of these patients had preoperative memory disturbances that were

mildly aggravated after surgery (both operated through combined approach) with preservation of the fornices. The third one had no preoperative memory complaint and showed an early return of normal memory within 5 days postoperatively and was operated by the direct transforaminal approach. This transient effect, which is still not higher than in the microsurgical approach, showed postoperative spontaneous improvement. It may be attributed to the manipulation of the fornices whether by the cyst itself or due to the balloon squeeze.

A total removal of the cyst capsule was not planned for in any of the patients. We removed as much as possible of the cyst wall and the remaining attached parts were coagulated and left in place to avoid any traction. We do believe, as others [14, 15, 24, 25], that a serious, endoscopically uncontrolled bleeding may follow this manoeuvre whose necessity is debatable.

In our series, there were no mortalities or permanent morbidities. The period of follow-up ranged between 5 months and 8 years and 3 months (mean: 4 years and 2 months). The regimen of radiological follow-up included a postoperative CT scan one day after surgery, MRI 3 months after surgery, one year after surgery, then every two years. We combined bipolar coagulation of the cyst capsule with cyst marsupialization, for continuous wash out of the formed colloid material if any by the circulating CSF. This combination could be the reason for the recurrence-free follow-up period amounting to 8 years and 3 months.

Conclusion

With an ascending learning curve, endoscopic colloid cyst resection could be the approach of choice. Through a single right precoronal burr hole at Kocher's point, several endoscopic manoeuvres can be done. These include aspiration of the contents or piecemeal removal, combined balloon squeeze and aspiration, foraminoplasty, pellucidotomy, coagulation of cyst capsule marsupialization of the cyst and ETV. The choice of the appropriate approach is largely dependent on the location of the cyst and the shape of the foramen of Monro.

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