



Colloid Cyst; Endoscopic Versus Transcallusal Approach

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Abstract

BACKGROUND: Colloid cyst is a rare congenital benign intracranial neoplasm, presented between 20 & 50 years of age. Open microscopic surgery is the standard approach, but the endoscopic approach is valuable alternative & astereotactic cyst aspiration is also tried nowadays.

OBJECTS: a retrospective comparative study for removal of colloid cyst of the third ventricle was made to compare between endoscopic trans-cortical & microscopicttranscallosal approaches.

MATERIALS & METHODS: Between 2008 & 2015, a 23 patients with colloid cyst of the 3rd ventricle were operated, the operations were 13 transcallosal craniotomy & 10 endoscopic procedure, the age of the patients varies from 9 to 63 years, there were 9 females & 14 males. The presentations were headache, nausea & vomiting, blurring of vision & gait disturbances.

RESULTS: In the 13 transcallosal patients, total excision is achieved in all of them, while in the 10 endoscopic procedure, only 2 total resection can be achieved & 6 cysts evacuated with coagulation of the wall, while in 2 viscous cysts, partial resection is achieved. All the colloid cysts were located in the roof of the third ventricle near the foramen of Monroe, except 2 cases, one in the posterior third ventricle & one in the lateral ventricle, both of them treated endoscopically. In the transcallosal group, 2 patients complicated postoperatively by severe memory loss in both patients, large cavum septumpellucidum was entered after callosotomy. Another One patient developed postoperative seizure. For the endoscopic group, in one case the cyst was located in the posterior 3rd ventricle, hydrocephalus persisted despite endoscopic third ventriculostomy prior to cyst resection.

CONCLUSION: Transcallosal approach is a standard approach for the treatment of colloid cyst of the 3rd ventricle. It is preferred in non dilated ventricles & in thick viscous hyperdense colloid cysts. In patients who are to be operated through transcallosal approach, the small subarachnoid space with inter digitation of cingulated gyri on coronal brain MRI indicate difficult separation of these gyri, in such a case, an extreme anterior approach should be performed & the dissection of the gyri is proceeded backward from inside to out side. A cavum septum pellucidum with the colloid cyst can lead to a forniceal body damage when the transcallosal approach is chosen, therefore endoscopic or microscopicttrans-cortical approaches may have a better outcome. Large head of caudate nucleus create a technical difficulty in advancing the endoscopic sheath, a smaller sheath should be used or transchoroidal approach should be planned initially. Symptomatic colloid cyst with slit lateral ventricles is approached through transcallosal approach.

Key Words: Colloid Cyst, Transcallosal approach, Endoscopic Trans-cortical Approach.

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Introduction

Colloid cysts are rare congenital, intracranial neoplasms, commonly located in the 3rd ventricle, accounting for 0.2-2% of all intracranial & 15-20% of intraventricular neoplasms.⁽¹¹⁾ Colloid cysts are slow growing & the initial onset of symptoms is usually between 20 & 50 years of age.⁽¹⁹⁾ Only 1-2% of all reported cases occurred during the first decade⁽¹⁴⁾. Although colloid cysts usually represent his to pathologically benign neoplasms, they can rarely result in sudden, unexpected & lethal complications.^{(11),(39)} Treatment option varies from observation in asymptomatic one to complete cyst excision, stereotactic cyst aspiration is also tried.^{(24),(25),(28)} Stereotactic microsurgical resection is a valuable approach in small sized cyst.⁽⁶⁾ The primary goal of treatment is complete resection. Open microscopic surgery is the standard approach, but the endoscopic approach is safe alternative to microsurgery.⁽²⁹⁾

Objectives

1. A comparison is made between endoscopic transcortical & microscopic transcallosal approach for removal of colloid cyst, comparing extent of resection including the wall, the safety of the procedure, the duration of surgery & hospital stay, the morbidity/mortality, the long term result, & a relative indications & contraindications are discussed for each approach.
2. General guidelines for anatomical & technical surgical limitations of microscopic transcallosal & endoscopic approaches are studied.

Patients and Method

A 23 patients with colloid cyst of the 3rd ventricle were operated between 2008 & 2015. A 13 microscopic transcallosal approach & 10 endoscopic procedure were performed, the age of the patients varies from 9 - 63 years with a mean of 40 years, there were 9 females & 14 males. The most common presentations were headache, nausea & vomiting, blurring of vision & gait disturbances, one patient presented as normal pressure hydrocephalus. The microscopic transcallosal

approach is performed through midline craniotomy as described by APPUZO et al with preservation of the bridging veins.⁽⁴⁾ The duration of surgery was about 240 minutes. The endoscopic procedure was performed through a linear incision on the coronal suture, Gaab set is used with ridged endoscope for working & flexible one for exploration the duration of endoscopic surgery was about 120 minutes. In the 13 transcallosal patients, total excision were achieved in all patients, while in the 10 endoscopic procedure, 2 total resection can be achieved & in 6 patients, cysts evacuation & coagulation of the wall was performed & in 2 patients with very thick content, partial resection was achieved. The duration of hospital stay was 5 days for endoscopic groups & 7 days for microscopic transcallosal group. The postoperative follow up period was one year.

Results

All the colloid cysts were located in the roof of the 3rd ventricle near the foramen of Monroe except 2 cases one in the posterior 3rd ventricle & one in the lateral ventricle in the thalamostriate sulcus, both of them were treated endoscopic ally. In the transcallosal group, total resection was achieved in all the cases. In the endoscopic group total resection was achieved in 2 cases, cyst aspiration with coagulation of the wall was performed in 6 cases & partial cyst evacuation is achieved in the remaining two. In the transcallosal group 2 patients suffered from severe memory loss with cognitive dysfunction. In both patients, large cavum septum pellucidum was entered after callosotomy and then the right leaflet was opened toward the right lateral ventricle. One patient developed seizure. No disconnection syndrome where recorded in the transcallosal group. In the endoscopic group, one case with posterior third ventricle colloid cyst, complicated persistent hydrocephalus, which mandate shunt procedure. There was average 2 hours extra time in the transcallosal approach (240 minutes) as compared with the endoscopic approach (120 minutes), & both groups were discharged in the 5th postoperative day, no disconnection syndrome had been recorded in the transcallosal approach.



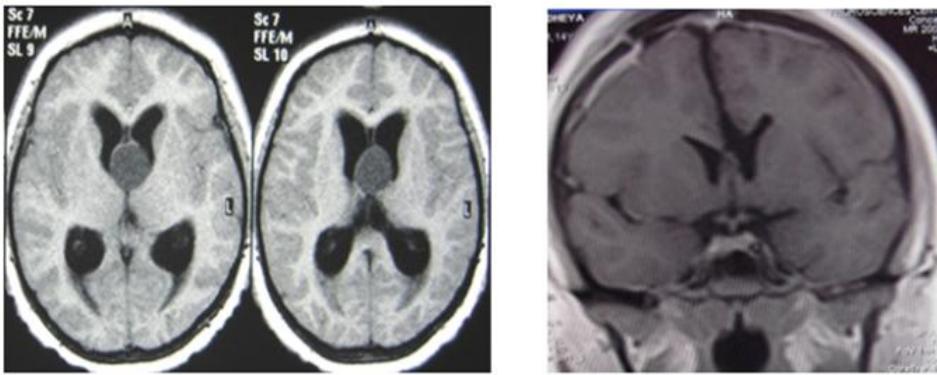


Figure 1a. Colloid syst with cavum septum pellucidum
b. Same patient postoperatively

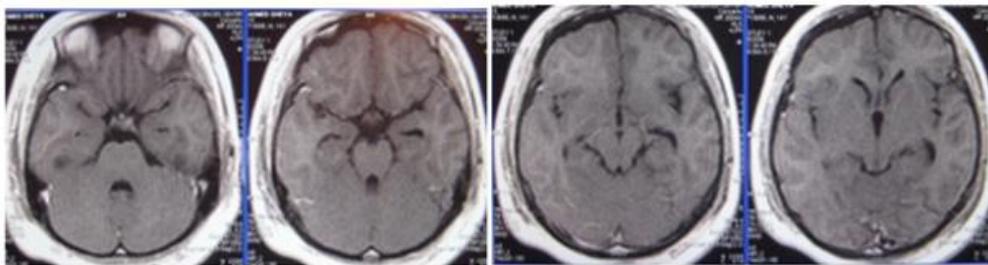


Figure 2: The same patient postoperatively

Discussion

Colloid cyst is epithelial benign cyst of no malignant transformation,⁽²⁰⁾ the treatment option varies from transcortical transventricular, transcallosal transventricular resection & purely endoscopic approach.⁽³⁵⁾ Other option is a stereo tactically placed tube retractor creating a minimally invasive transventricular approach.⁽¹²⁾ Early reports of this approach showed promising results, but the rate of recurrent cysts was high & it has been replaced by endoscopy.^{(8),(25)} No clear cut rules to choose among these approaches.^{(17),(35),(37),(41)} The Transcallosal approach can provide easy approach to the lateral & third ventricle, & with proper planning it can reduce the morbidity associated with resection of lesions in these compartments.⁽²¹⁾ In this study, we found that the microscopic transcallosal approach achieved total cyst excision with excellent result compared with the endoscopic approach. Ahmed B. Sheikh & his colleagues, operated 583 patients with microsurgical approach & 695 patients with endoscopic approach, the microsurgical approach have higher gross total resection rate (96.8% vs. 58.2%), lower recurrence rate (1.48% vs. 3.91%), & lower reoperation rate (0.38% vs. 3.0%) compared with the endoscopic group. There was no significant difference in mortality rate (1.4% vs. 0.6%). The morbidity rate was lower in the

endoscopic group (10.5%) than in the microsurgery group (16.3%).⁽³⁾ Regarding the postoperative complication, we found that in the transcallosal group 2 patients suffered from severe memory deficit. One patient developed seizure controlled with anticonvulsant therapy, no disconnection syndrome had been recorded. We did not have mortality. Nigel Peter Symms & his colleagues found in their study that 3 patients had impaired recent memory & none had a disconnection syndrome. An 2.5 cm incision in the anterior corpus callosum does not result in disconnection disorder & they had 2.6% postoperative deaths with basal ganglia hemorrhagic infarct & intraventricular bleed.⁽³¹⁾ Woiciechowsky & his colleagues & Bogen JE & his colleagues, also confirmed no disconnection syndrome as the splenium remained intact in less than 22 mm length callosotomy.^{(46),(7)} Stachura K. & his colleagues found that, in all transcallosal treated patients, the cyst were completely removed, one patient was reoperated because of intracerebral haematoma, 2 patients suffered from temporary hemiparesis, 2 patients developed epilepsy & 3 patients hydrocephalus.⁽⁴⁰⁾ Kehler U. & his colleagues found that the Complications in the microsurgical group: 1 subdural effusion, 1 flap infection, 1 mild hemiparesis, & 1 pulmonary embolism.⁽²²⁾ Complete resection was achieved in 8 of 10 cases of microsurgery.⁽²²⁾ In the endoscopic

group, we had one complication of hydrocephalus which remained despite endoscopic third ventriculostomy & mandate shunt procedure. Eric M. Horn & his colleagues found that the Intermediate follow-up demonstrated more small residual cysts in the endoscopic group than in the transcallosal craniotomy group.⁽¹²⁾ Stachura K. & his colleagues found that in 6 from 10 endoscopically treated patients, the tumours were completely removed, postoperatively, 2 patients had memory deficits, one patient developed temporary mutism.⁽⁴⁰⁾ Kehler U. & his colleagues found that the endoscopic group complicated by one intraoperative bleeding, 1 stitch granuloma, 1 mispuncture of the ventricle, & 1 meningitis, complete resection was achieved in 3 of 10 cases in endoscopy.⁽²²⁾ Endoscopic management had a higher recurrence rate in long-term follow-up. In the endoscopic study of Maurizio Iacoangeli et al, they found that the post operative complication was only for one patient who experienced a transient memory deficit.⁽²⁹⁾ Fernando Campos Gomes Pinto & his colleagues found in their endoscopic study that there is transient morbidities in 2 patients, one had transient diabetes insipidus & another one had aseptic chemical meningitis.⁽¹³⁾ We suggest in our study, that: The thick content of the colloid cyst is considered as an endoscopic challenge. Kondziolka D. & Lunsford LD. concluded that unsuccessful stereotactic aspiration was related to 2 features: the high viscosity of intra-cystic colloid materials or the small cyst volume.^{(24),(25)} The thick viscous content of the colloid cyst appears hyperdense on CT scan, So microscopic transcallosal approach in hyperdense colloid cyst is recommended, where the cyst can be evacuated using biopsy forceps, tumor holding forceps or micro dissector or pituitary ring curette, while in endoscopic procedure the transparent catheter aspiration & small artery forceps are the only tools that can be used.^{(1),(23),(34),(36)} Kondziolka & Lunsford found that hyperdense cysts were unlikely to be aspirated successfully.^{(24),(25)} The analysis of Donaldson & Simon suggested that sodium, magnesium & calcium within the mucin of the cyst & the calcium bound to prealbumin may contribute to the density.⁽¹⁰⁾ Mader & his colleagues stated that, the increased CT density i.e. viscosity & hyper intensity on T1W & T2W images are related to high protein/cholesterol cystic contents.⁽²⁷⁾ On MRI, they also correlated high signal on T1-weighted sequences with high cholesterol contents.⁽²⁷⁾ Ahmadi & his colleagues found that

cystic fluid that is hypo intense on T1W & hyper intense on T2W images tends to be watery & easily aspirated.^{(2),(31)} Peragut & his colleagues reported successful stereotactic aspiration in colloid cyst with hyperintense T2-weighted images.⁽³²⁾ Wilms & his colleagues found that, the low signal on T2-weighted sequences was related to a viscous colloid slimy material that had the consistency of motor oil.⁽⁴⁵⁾ Carl El Khourya & his colleagues series established correlation between intracystic low signal intensity on MRI long-TR sequences, or CT hyper dense cysts, and viscous or hard intracystic content, making the aspiration procedure very difficult or impossible.⁽⁸⁾ The existence of cavum septum pellucidum together with the colloid cyst, were encountered in 2 cases in our study & in both of them, a transcallosal approach were tried, in both patients large cavum septum pellucidum was entered after callosotomy & then the right leaflet was opened toward the right lateral ventricle. Total resection were achieved in both cases, but both developed severe memory loss especially verbal memory lasting up to 3 months & affect school performance in one patient. We think that getting out of the cavum toward the lateral ventricle will damage the body of the fornix which is splayed over the lateral wall of the cavum & therefore the fornix damage is unavoidable. In the reported case of Kuan-Yin Tseng operated through anterior transcallosal approach on a 3rd ventricular tumor with cavum septum pellucidum, he found that the interforniceal approach lead to damage to the fornices, the internal cerebral veins & the posterior medial choroidal arteries, causing bilateral fornix injury.^{(26),(42)} The tumor was located in the anterior superior third ventricle, lifted up the floor of cavum septum pellucidum & obstructing the foramen of Monroe.⁽²⁶⁾ Timurkaynak E. & his colleagues found that a routine callosotomy in case of cavum septum pellucidum (CSP), may cause confusion while entering the CSP due to the invisualization of ventricular landmarks such as the foramen of Monro, thalamostriate vein, & choroid plexus, so the interforniceal approach is not a routine way with higher morbidity.⁽⁴²⁾ Ricardo Brandão Fonseca & his colleagues stated that, if the thalamostriate vein appears to the right of the foramen of Monroe, then the right lateral ventricle has been entered; if it appears to the left, then the left lateral ventricle has been entered; & if no vein is visualized, a cavum septum has been encountered.⁽³³⁾ Nigel Peter Symms & his colleagues found that memory deficits may



also arise from trauma to the basal forebrain nuclei, thalamic nuclei, septal nuclei, & inferior thalamic peduncle.⁽³¹⁾ Woiciechowsky C. & his colleagues found little influence of one-forniceal lesion on recent memory if the contralateral fornix is intact.⁽⁴⁶⁾ Nakasu & his colleagues stated that injury to adjacent structures such as cingulate gyrus, trauma to the wall of the anterior third ventricle & floor of the lateral ventricle & damage to the dominant supplementary motor cortex may lead to postoperative mutism.⁽³⁰⁾ Hernesniemi has found that the far lateral corpus callosal incision has been valuable in avoiding memory disturbances.⁽¹⁸⁾ Desai KI & his colleagues operated 105 colloid cysts by transcallosal approach with 14 patients developed transient memory loss and 2 patients developed permanent memory loss.⁽⁹⁾ Callosal incision can be done away from the cavum directly toward the lateral ventricle but this necessitate extreme lateral retraction of the medial frontal lobe, the alternative is endoscopic approach or the transcortical approach. Woiciechowsky & his colleagues found that 3.7% of their patients had anazygous pericallosal artery, requiring a callosotomy lateral to the pericallosal arteries.^{(31),(46)} Türe et al show that the high incidence of posteriorly located anterior septal vein-internal cerebral vein junctions is a significant factor influencing the successful course of surgery.⁽⁴³⁾ Ricardo Brandão Fonseca & his colleagues found that the classic incision in transcallosal approach is 2 cm long, 2.5 cm behind the genu of the corpus callosum, placing the foramen of Monroe in the operative field.⁽³³⁾ Incision is made between the pericallosal arteries & for the inter-forniceal approach, the septum pellucidum is identified & split strictly midline by blunt dissection until the thick fibers of the fornix were visible.⁽³³⁾ Arthur J. Ulm & his colleagues stated that The transcallosal approach has 3 main variations: Inter-forniceal, sub-choroidal, & trans-choroidal.^{(5),(43)} The sub-choroidal approach involves opening the choroidal fissure on the thalamic side & retracting the fornix & choroid plexus medially.⁽⁵⁾ Türe U. & his colleagues believe that opening the fissure on the thalamic side places the major draining veins, such as the thalamostriate & caudate veins at risk.⁽⁴³⁾ Arthur J. Ulm & his colleagues stated that the standard callosotomy is 2 cm in length & is begun 2.5cm behind the genu of the corpus callosum; however, a more anteriorly placed incision is necessary for lesions around the aqueduct & pineal gland; a more posterior incision is needed for

lesions in the anterior 3rd ventricle in front of the foramen of Monroe.⁽⁵⁾ A challenging endoscopic problem had been faced when the rigid endoscope is advanced to the lateral ventricle, there is large head of caudate nucleus that protrude to the cavity of the frontal horn that makes very narrow cleft with foramen of Monroe, in this particular case a trans-choroidal approach had been chosen in the initial phase of the operation until the foramen of Monroe is separated from the head of caudate nucleus, then the procedure was proceeded in the usual manner.

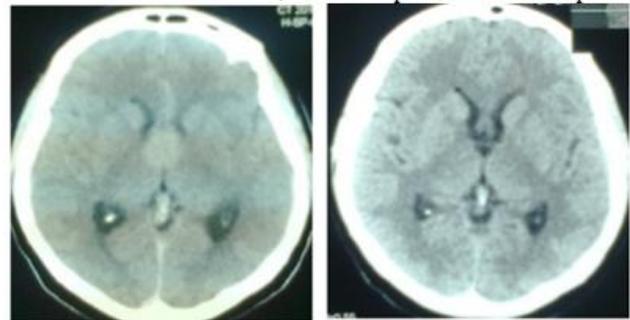


Figure 3. A. isodense colloid cyst with large head of caudate n. with slit ventricle B. postoperatively

Careful study of the preoperative MRI can show this variation & one should plan from the beginning to use the miniGaab set instead of using the standard one with potential risk of neural injury by the sharp edges of the sheath end that it is out of vision in the current endoscope. An endoscopic trans-foraminal approach to the third ventricle is not always safely applicable & one needs to open the choroidal fissure in the more voluminous posterior part of the body of the lateral ventricle for initial aspiration &/or dissection of the colloid cyst wall. This difficulty also found In the experience of Maurizio Iacoangeli & his colleagues, where they found that the endoscopic approach to the third ventricle performed through the foramen of Monroe provide inadequate view of the cyst's attachment to the telachoroidea, & necessitating a blinded stripping away of cyst capsule from the roof of the third ventricle.⁽²⁹⁾ So, in firmly adherent colloid cysts to the tela choroidea, this poor visualization through the foramen of Monroe caused unwanted damage to vessels along the roof of the third ventricle.⁽²⁹⁾ So, the trans-choroidal- trans-foraminal approach is preferred in all cases in which the cyst is firmly adheres to the telachoroidea or inserted in the middle/posterior third ventricular roof.⁽²⁹⁾ Maurizio Iacoangeli & his colleagues stated that the combined endoscopic trans-foraminal-trans-choroidal approach (ETTA) offers 2



different corridors through which the cyst can be manipulated & removed, reducing the traction on the foramen of Monroe & avoiding traumatization of the fornix.⁽²⁹⁾Schroeder HW & Gaab MR suggested that the use of a trans-choroidal route does not increase the risk of neurological complications because it takes advantage of a natural corridor between the third & lateral ventricles.⁽³⁶⁾Greenlee JD. & his colleagues see that, because the choroidal fissure is the thinnest site in the wall between the lateral & third ventricles, it can be safely opened to connect the 2 ventricles.⁽¹⁵⁾Grondin RT & his colleagues & Eric M. Horn & his colleagues advocate the use of a more anteriorly located burr hole & the use of a 30° scope as an alternative to opening the choroid fissure to access the colloid cysts of the posterior third ventricle.^{(12),(16)}Maurizio Iacoangeli & his colleagues said that the use of this approach for posteriorly located lesions can cause contusions on the anterior column of the fornix or bleeding from choroid plexus or thalamostriate/septal vein.⁽²⁹⁾This is probably due to the angulation of approximately 20° of the foramen of Monroe from the sagittal plane, exposing the anterior column of the fornix & the veins to unwanted damage.⁽²⁹⁾In transcallosal approach, the adhesivability of the cingulate gyri interdigitations or overlapping of these gyri indicate difficult separation of them & thus dangerous transcallosal approach. The solution for this technical problem is to go anteriorly at the genu of the corpus callosum, where the frontal lobe are usually separated from each other, identifying the corpus callosum & then marching backward from an inside to outside, identifying both pericallosal arteries & separating cingulate gyri in the same fashion as the technique of opening the sylvian fissure.

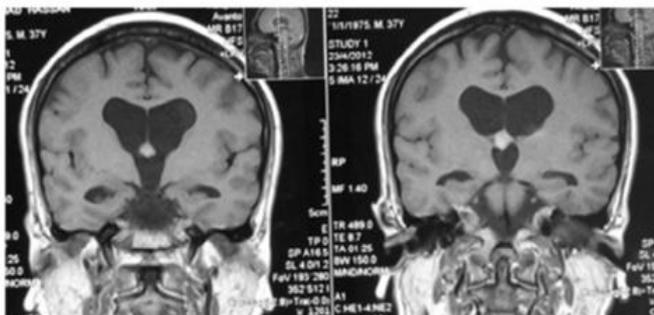


Figure 4: Colloid cyst with separated cingulated gyri that make the transcallosal approach

The last guideline in our study, was the symptomatic colloid cyst with slit ventricle. Perhaps, microscopic transcallosal approach is

good choice, since neither microscopic trans-cortical nor endoscopic approaches can be safely reached to the lateral ventricle. Souweidane study & Wait & Scott D. study concluded that, the absence of ventriculomegaly should not serve as a contraindication to endoscopic tumor resection.^{(38),(44)}

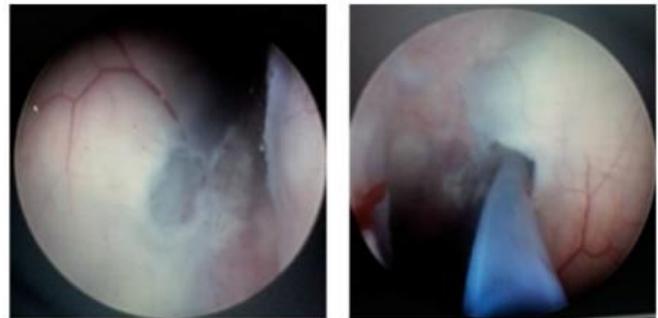


Figure 5: A: Endoscopic view of body of lateral ventricle. B. Puncturing & aspiration of colloid cyst



Figure 6: Total removal of colloid cyst via endoscopic transchoroidal-transforaminal approach

Conclusion

Colloid cyst is rare curable disease, transcallosal approach is standered approach, it should be the preferred done in the cases of non dilated lateral ventricle & we prefer it over the endoscopic approach in thick viscous content cyst, endoscopic CUSA will probably make the endoscopic approach superior to others in thick hyperdense colloid cyst. The absence of subarachnoid space with interdigitation & overlapping of cingulated gyri indicate difficult separation. The existence of cavum septum pellucidum with the colloid cyst can lead to a significant forniceal body damage, therefore endoscopic or microscopic transcortical approaches may have a better outcome. Large head of caudate nucleus form a kissing phenomenon with the foramen of Monroe create a technical difficulty. Symptomatic colloid cyst with slit lateral ventricles is approached solely through transcallosal approach.

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