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Original Article

Colloid cyst of third ventricle: report of 11 cases with transcallosal transforaminal and transcolumna fornicis approach and clinical, radiological features

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Abstract: We evaluated, the clinical findings, radiological evidences, operation technique, complications and outcome in third ventricle colloid cysts and assessed the most safe and easy surgical approach for the treatment. 11 cases of third ventricle colloid cyst who underwent transcallosal operation between 2009-2017 were analysed retrospectively. In 10 of these cases cyst was visualised through foramina monro and in nine of them cysts were easily removed. We additionally applied posterior inter fornicial approach to the 10th case. In the 11th case the cyst could not be visualised through foramina monro and was found to be burried in paranchyma between foramina monro and commissuria anterior. The cyst was removed through the incision performed to columna fornicis lying on the cyst. Up to our knowledge third ventricle colloid cyst at this location is not reported in literature. Transcallosal, transforaminal and interfornicial approach which enables total resection with low complication and reccurence rate can be estimated as the most reliable procedure.

Keywords: Transcallosal transforaminal, transcolumna fornicis, colloid cyst, third ventricle, craniotomy, surgery, treatment

Introduction

Colloid cyst of 3rd ventricle comprises 0.3-2% of brain tumors. Although it is among uncommon and benign brain tumors neurologic deterioration and death is unavoidable if treatment is neglected. It is known to be an embryologic tumor but there is not a consensus about its origin. Therefore, ependymal cysts, paraphysial cyst, neuro epithelial cysts, choroid plexus cyst are the terms used for this tumor. Some authors consider that it has neuroectodermal origin and arises at the 7th week of embrion, forms the ceiling of rostral diencephalon and diencephalon at the 10th week and develops from the embrional remnant of completely regressed paraphysis. Some authors suggest that it is originated ectodermally from Rathke's cleft cysts and suprasellar neuroenteric cysts. Observation of ciliates cell, nonciliated microvilli, goblet cell, basal cell similar to respiratory and intestinal ephitelium by electron micoscopic examination supports this opinion.

It is frequently seen at 2-5th decades but cases aging between 2 months to 82 years are reported in literature. It is most frequently seen at the fourth decade and in males. Hereditary predisposition is not available but familarity have been reported [1-6].

It settles at the anterior half of the 3rd ventricle ceiling, between the fornixs and binds to choroid plexus with a loose fibrous band in 99% of the cases. Multiple cysts in different sizes can be observed in this region incidentally at autopsy, Computed Tomography (CT) or Magnetic Resonance Imaging (MRI). Existence in posterior part of 3rd ventricle, in septum pellucidum and vellum interpositum, also, rarely in 4th ventricle, frontoparietal cortex, inside sella has also been reported.

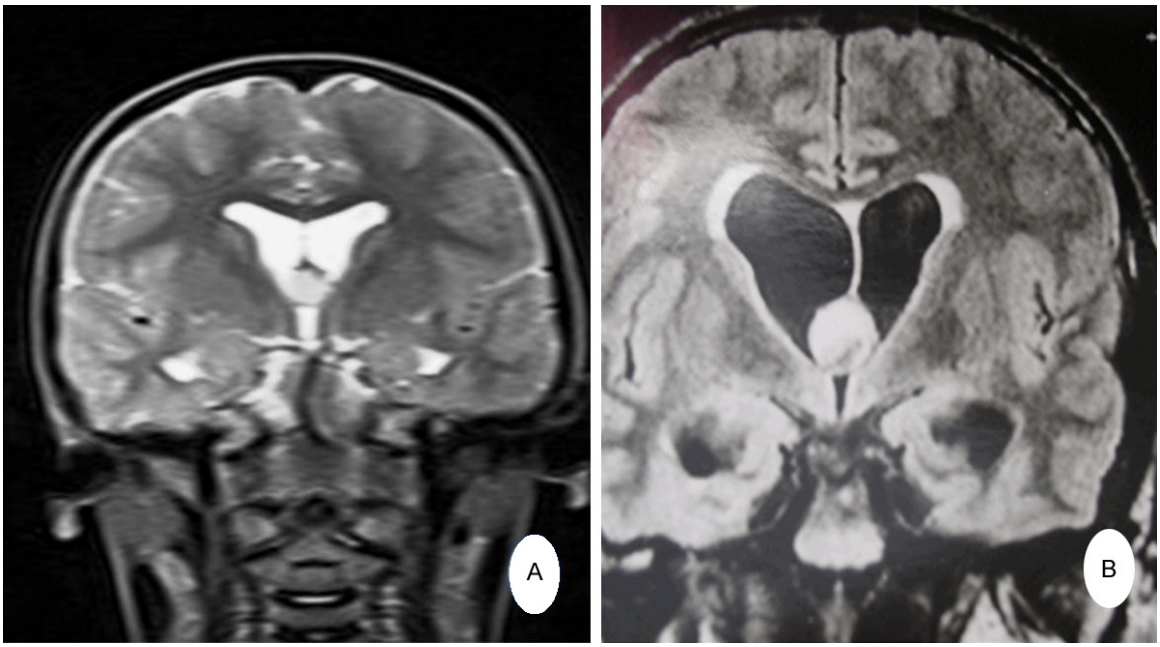

Figure 1. Colloid cyst located in the third ventricle. A. Coronal T2-weighted MRI (6 years old), 4th case. B. Coronal T1-weighted MRI (70 years old), 8th case.

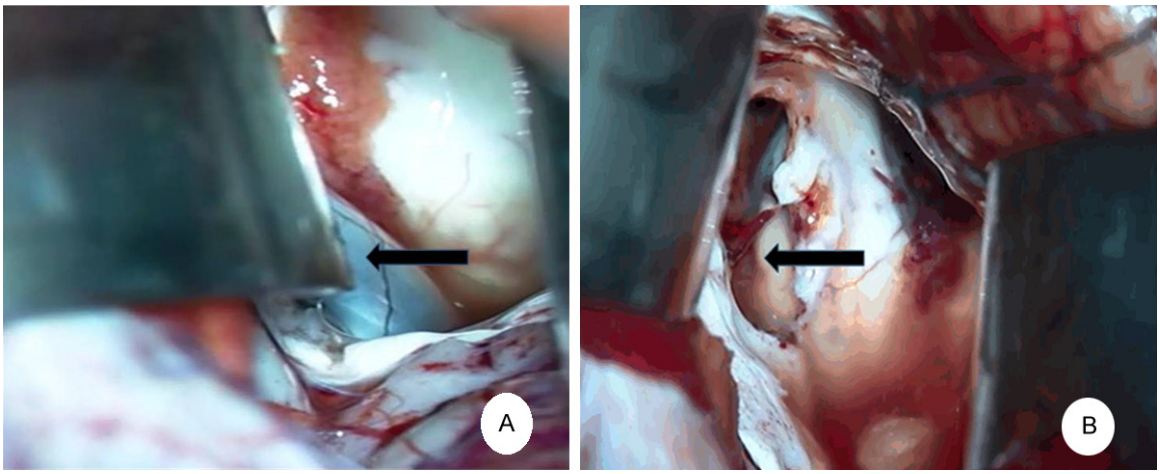

Figure 2. Intraoperative picture. A. Septum pellicidum, B. Opening septum pellicidum, 9th case.

Most of the cases do not have neurologic deficit and are diagnosed incidentally. The most frequent symptom is headache and vomiting, transient diplopia, blurred vision, weakness in lower extermities, drop attack, mental detoriation may be the accompanying symptoms. Coma and sudden death is reported [2, 5, 7-11].

We present 11 cases with 3rd ventricle colloid cyst who except one underwent transcallosal transforaminal operation between 2009-2017 at Acıbadem Adana Hospital and University of Cukurova, Balcali Hospital. We evaluated the complaints of patients, radiological evidences, operation technique and complications of colloid cysts.

Case report

This retrospective study included 11 cases (7 male, 4 female) with colloid cyst. The patients age ranged from 6 to 70 years (**Figure 1**). 10 of them underwent transcallosal, transforaminal approach. The cyst was burried in paranchyme between foramina monroe and commissura

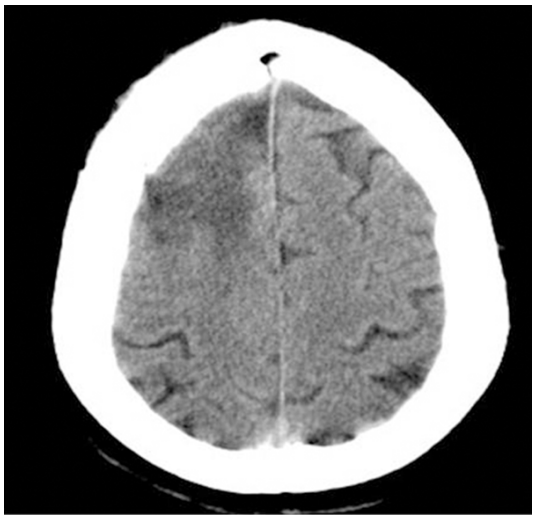

Figure 3. Right frontal infarct due to venous thrombosis in the CT scan 2nd case.

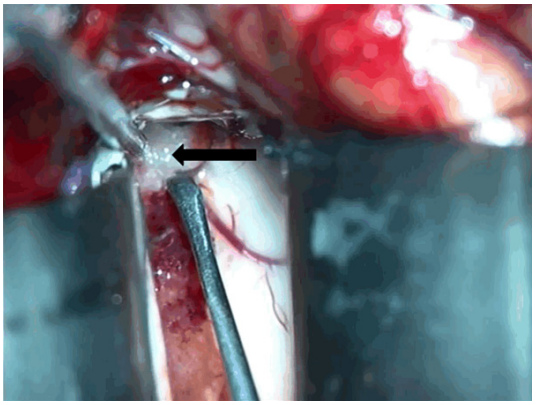

Figure 4. Appearance of the cyst (Intraoperative Picture), 3rd case.

anterior and could not be visualised in the 11th case and was removed through the incision performed on columna fornicis. We introduced to the ventricle by right frontal craniotomy in 10 and left frontal craniotomy in 1 patient and cysts were excised totally by transcallosal transforaminal operation in 10 cases. In the 10th case only the left ventricle was large so we introduced to the left ventricle transcallosally by craniotomy, we hardly found left monro, the cyst was settled at the posterior and was covered with ependyma and vascular structure. We enlarged foramina Monro to the posterior interfornicially and removed the cyst totally.

In the 11th case the cyst could not be visualised through foramina monro and was found to be burried in paranchyma between foramina monro and commissuria anterior. The cyst was removed through the incision performed to the columna fornicisbetween comissura anterior and foramina Monro.

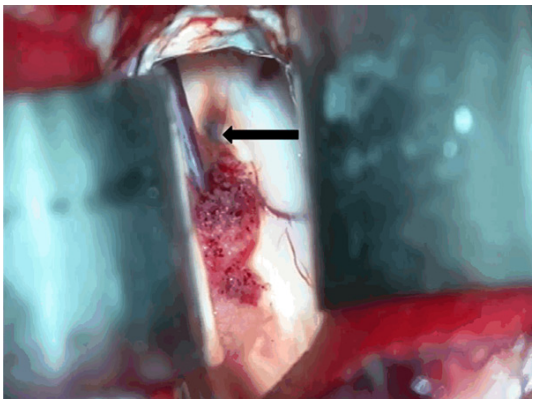

Figure 5. Entrance of septal vein thalamostriat vein and and choroid plexus to the right ventricle (Intraoperative picture), 6th case.

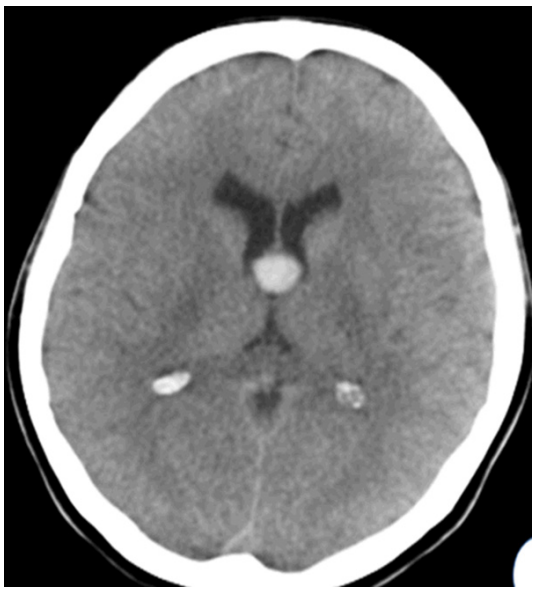

Figure 6. Colloid cyst located in the third ventricle, definite image with CT scan, 10th case.

Septum pellusidum was opened and opposite monro was controlled in every patient (**Figures 2A**, **2B** and **9**).

Results

11 cases diagnosed as 3rd ventricular cyst was operated at our clinic between 2009-2017 (**Table 1**). The most important symptom was headache and was present in 9 cases, in 3 of

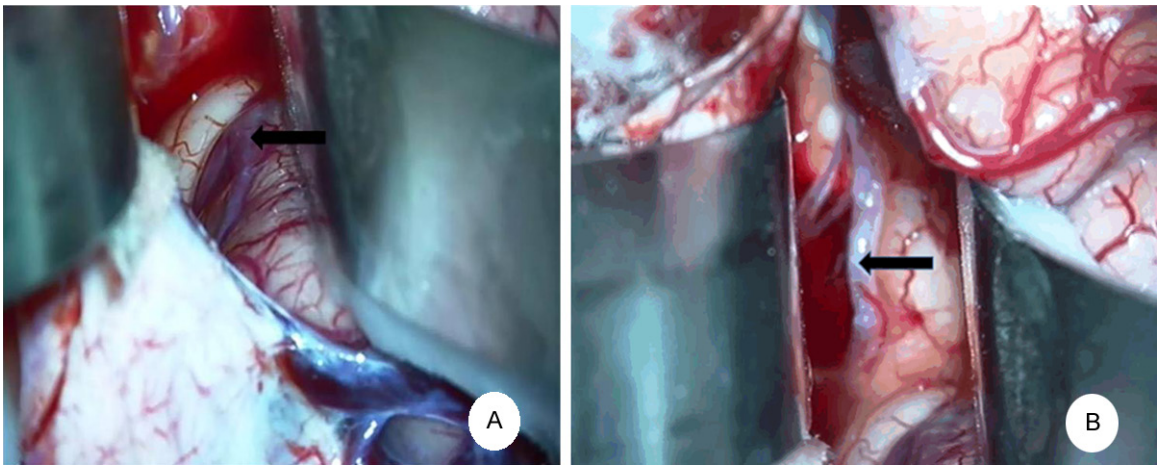

Figure 7. Intraoperative picture. A. Bridge vein. B. Pericallosal artery, 6th case.

Figure 8. Fibrous band, 6th case.

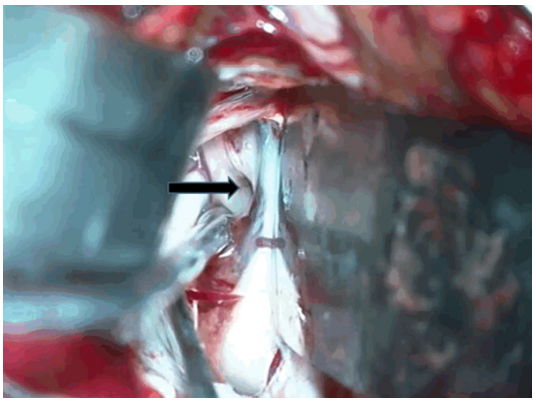

Figure 9. Appearance of left monro following transsection of septum pellucidum, 5th case.

them it was epizodic and was together with nausea and vomiting. 3 cases with dementia, guide disturbance and incontinence were prediagnosed as adult hidrocephalus and their MRI revealed colloid cyst (**Figure 1**). The complaints of cases with colloid cysts were visual disturbance in 2, history of unconsciousness in one, mental status changes in 2 cases and duration of the symptoms ranged from one week to six months.

All of the patients were diagnosed with MRI, 5 patients also underwent CT examination. Diameter of the cysts ranged from 6 mm to 2 cm. We detected bilateral ventricular dilatation in 7 cases. Left lateral ventricle was found to be dilated in 1 case.

The most frequent postoperative complications were mental status changes and memory disturbance. Behavioral changes has been noted in most of our patients. We did not apply preoperative psychological test to our patients. We informed the patients about sterotaxic and endoscopic operation alternatives that we dont have experience and directed 5 patients to other centers. We detected hidrocephalus in 8 cases. Observance of postoperative aphasia in the 10th patient was attributed to lateral ecartation of left ventricle.

None of our patients required drainage. Epilepsy and infarct due to right cortical vein thrombosis developed in one patient (**Figure 3**). In one of our patients cutaneous infection due to staphylococcus albus developed and recovered with antibiotic therapy. Hydrocephalus regressed in 5, stayed steady in 3 cases. We did not detect aquaductus stenosis and did not apply ventriculo peritoneal shunt. None of our patients died.

Table 1. Clinical, radiological features and treatment results of patients

Patient	Age	Gender	Clinical Symptoms and signs	CT Scan	MRI T1 weight	MRI T2 weight	Surgical Procedure	Postoperative Complication	Follow-up Period (Month)	Clinical and Radiological Result
1	38	M	HA, N, V	-	Hypo	Hyper	Transcallosal Transforaminal	Mental Disturbance	36	Stable
2	35	M	Unconsciousness	Hypo	Hyper	Hyper	Transcallosal Transforaminal	MSC, MD	12	Stable
3	56	M	HA, DDI	Iso	Hypo	Hypo	Transcallosal Transforaminal	Behavioral Changes	6	Stable
4	6	F	HA, N, V	Iso	Hypo	Hyper	Transcallosal Transforaminal	BC	6	Stable
5	28	F	HA, VD	-	İso	Hyper	Transcallosal Transforaminal	BC, cutaneous infection	1	Stable
6	31	F	HA, MSC	-	Hypo	Hypo	Transcallosal Transforaminal	MSC, BC	6	Stable
7	45	M	HA, VD	-	Hyper	Hypo	Transcallosal Transforaminal	MSC, BC	12	Stable
8	70	F	DDI	Iso	İso	Hyper	Transcallosal Transforaminal	BC	1	Stable
9	42	M	HA, N, V	-	Hyper	Hypo	Transcallosal Transforaminal	MD, BC	1	Stable
10	63	M	HA, DDI	Hyper	Hypo	Hypo	Transcallosal İnterfornicial	MSC, Aphasia	12	Stable
11	39	M	HA, MSC	Hyper	İso	Hyper	Transcallosal Transcolumna Fonicis	Epilepsy, MD, Hemiparesis	12	Stable

HA: Headache, N: Nausea, V: Vomiting, BC: Behavioral changes, DDI: Demans Guide disturbance Urinary incontinance, VD: Visual disturbance, MSC: Mental status change, MD: Mental disturbance.

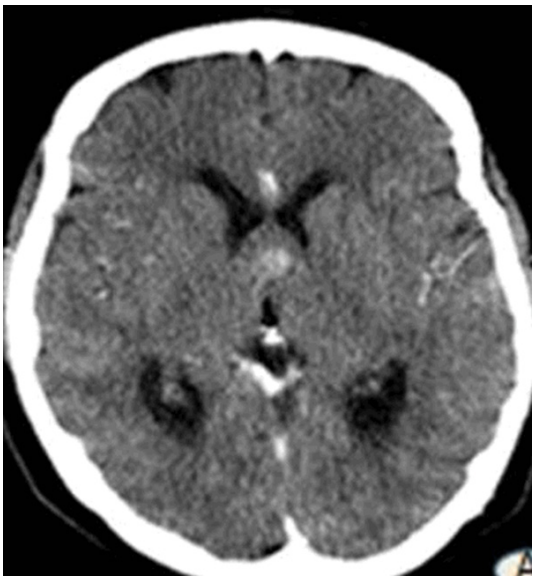

Figure 10. The cyst was burried between columna fornics commisura anterior and Foramino Monro in the CT scan, 11th case.

In one of our patients cutaneous infection due to staphylococcus albus developed and recovered with antibiotic therapy. Our follow up periods were 3 years for one case, 1 year for 4 cases, 6 months for 3 cases. 3 cases dropped control examinations at the 1st month.

Discussion

Colloid cysts are considered to be benign, non-invasive, congenital lesions. Seeding and malign degeneration do not occur. It can fill the 3rd ventricle and exceed to lateral ventricle through foramina Monro. Its size varies from 5 mm to 25 mm. Cyst itself has a spherical or ovoid semi-translucent wall and its content is greenish (**Figure 4**).

The choroidal plexus adhesions are fibrinous, not vascular (**Figure 8**). The wall of the cyst is formed of pseudo stratified single layered columnar or cuboidal epithelium covered with thin fibrous capsula single layered ependym. Cyst diamater larger than 1 cm obstructs Foramina Monro and protrudes through lateral ventricle and is coated with second ependym layer which is covered with thin vessels. Therefore, visualisation of Foramina Monro and the cyst during operation is not easy, entrance of choroid plexus, thalamostriate and septal veins to foramina monro should be found inorder to visualize Foramino Monro (**Figure 5**).

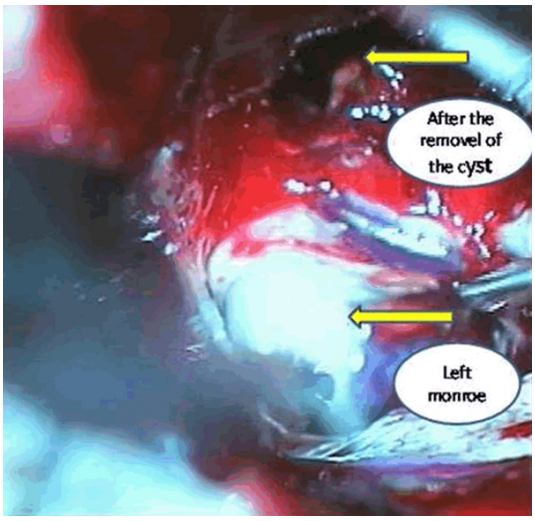

Figure 11. Cyst infront of left Monroe. Cyst with a dimension of 2×1.98 cm could be visualised following inter fornicial incision, 11th case.

Foramina Monro, outpouring area of thalamo striate and septal vein to internal cerebral vein should be detected by digital subraction angiography or CT angiography preoperatively. Existence of wide bridge vein located 2-3 cm infront of coronary suture should be detected intraoperatively [2, 8, 12, 13].

9 patients complained from headache. In literature it is mostly paroxysmal headache occuring with ball-valve mechanism due to position. Only one of our patients had positional headache, in other cases it resembled migraine headache. Cyst should be mobile and adhered with a thin pedincule to 3rd ventricle ceiling for ball-valve mechanism. But, most of the cysts are adhered with wide base and are immobile. Headache is frequently due to raised intracranial pressure (ICP) as a result of occlusion of Monro but, we did not detect papil stasis in our patients [2, 14-16]. Transient diplopia and blurred vision may accompany this symptom [2, 6, 9, 17, 18]. One of our patients complained about transient blurred vision and one patient complained about decrease in vision preoperatively. Both of these patients ophthalmic examination was found to be normal.

3 of our patients who had paroxysmal demans, guide disturbance, urinary incontinance were diagnosed as hidrocephalus. MRI revealed colloid cyst in 2 of these cases whereas iso intense colloid cyst was unnoticed in MRI of the 3rd patient. He also had cortical atrophy and lum-

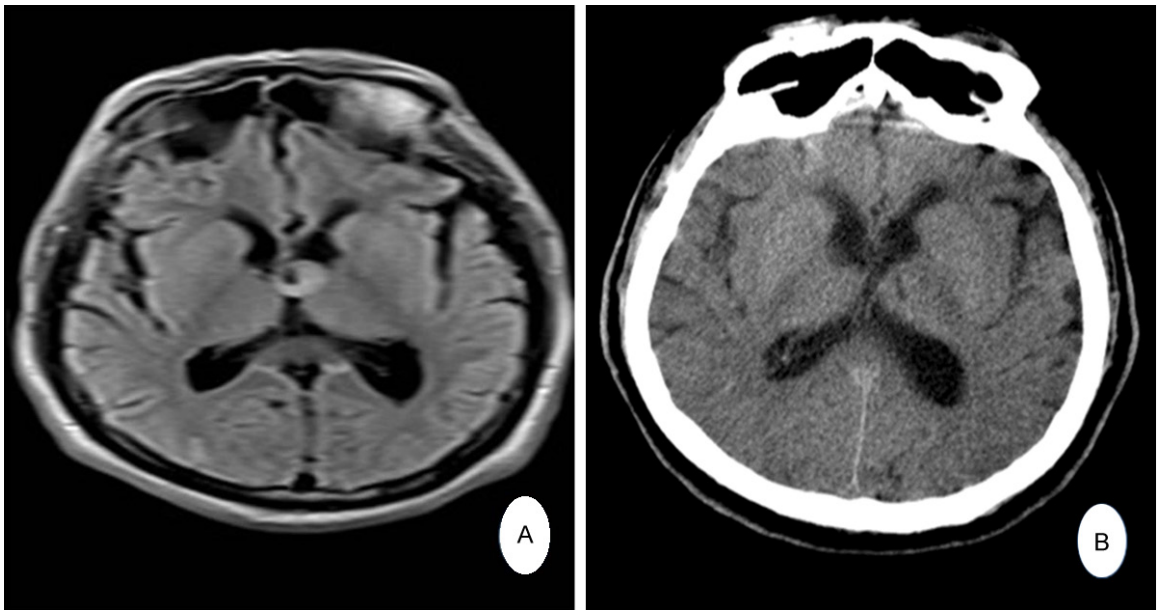

Figure 12. A. Colloid cyst located in the third ventricle (Preoperative Axial T1-weighted MRI); B. Appearance of 3rd ventricle through monro following the removal of colloid cyst (Postoperative CT scan), 7th case.

bar puncture (LP) was applied considering the recovery of symptoms but following the detoriation of the status CT examination was performed and colloid cyst was diagnosed. MRI Scanning technique failed to predict the viscosity of the cyst contents and in this respect CT scan can be considered to be superior (**Figure 6**).

Mental status changes, memory disturbance, emotional, personality changes, deterioration in consciousness, ataxia, visual disturbance, symptoms resembling korsakoff syndrome may develop due to impression of the cyst to the surrounding area in cases with increased ICP. Only one of our patients complained from headache together with visual disturbance.

Colloid cyst have been diagnosed with pneumoencephalography, ventriculography, angiography and brain scanning. Nowadays, brain MRI and CT is competence for diagnosis. Rounded or ovoid lesion lying in the region of the anterior third ventricle adjacent to foramina Monroe with 5-25 mm diameter is pathognomonic for colloid cyst.

MRI mostly reveals high signal and visualisation of cysts containing blood and hemosiderin is better. Observation of high or low signal is not correlated with signs.

If the patient is presenting with headache or demantia, has neurologic symptoms, ventriculomegaly and high signal in T2 weighted MRI, cerebro spinal fluid circulation must be reestablished even if the patient is alert [5, 16, 18, 19].

Operation should be performed in patients with acute hidrocephalus, deep venous obstruction and acute neurologic deterioration due to impression to the hypothalamic regulatory system. Treatment of asymptomatic colloid cyst is controversial. Asymptomatic cyst in old patients with a diameter smaller than 8 mm can be followed up with MRI examination per year. Operation is decided if ventricular enlargement and neurologic symptoms develop.

8 of our cases had hydrocephalus, ventricular diameter was normal in 3 cases and no signs were present other than headache, nausea, vomiting, demantia, incontinance, guide disturbance. The most catastrophic event associated with colloid cyst of the third ventricle is sudden death. Pallock [3] postulated that sudden death is not only due to the size of the tumor and acute ventricular dilatation or duration of symptoms. Reflexes effecting cardiovascular centers near the third ventricle might also have played a role in these patients. Incidence of sudden death is not known and young patients should be operated because of this reason.

The aim of treatment is preventing the development of hydrocephalus, sudden neurologic deterioration and death. Extirpation and aspiration therapy is still controversial [2, 18, 20-23].

Besides transcallosal transforaminal surgery interhemispheric, frontal transcortical, subfrontal or bifrontal anterior inter hemispheric approach through both lamina terminalis can be performed. Following transcallosal lateral ventricle insertion entrance to the 3rd ventricle can be performed through transforaminal, suprachoroidal, subchoroidal, transvellum inter positum or interforniceal approach.

Endoscopic, stereotactic aspiration and excision of the cyst wall are the other options for treatment. Cortical venous anatomy, pericallosal artery septal vein thalamo striate and internal cerebral vein should be visualised and localisation of foramina Monro should be determined by angiography prior to transcallosal operation. Frontal bridge vein lesion should be prevented in interhemispheric approach (**Figure 7**).

If the right side is not convenient entrance can be done from the left side. Following the ecartation of the hemisphere infront of the coronary suture entrance to the right lateral ventricle through gyrus cinguli and corpus callosum can be performed.

Right Monro can be visualised by following choroid plexus. Colloid cyst looks grey if it is protruded to the lateral ventricle (**Figure 4**). However, it is not easily seen because it is covered with double layered ependym, septal vein, thalamostriat vein and choroid plexus. If choroid plexus is not in frontal horn foramina Monro is settled posteriorly. Monro is enlarged frequently, cyst material can be punctured and aspirated inorder to perform internal decompression.

Fibrous bands of the capsule adhering to the ceiling of 3rd ventricule and choroid plexus can be cut following coagulation (**Figure 8**).

The wall of the cysts can be delivered though the foramen monro using microsurgical dissection techniques, additonal techniques are rarely required. Following the removal of the cyst inorder to control the opposite Foramino Monro septum pellucid should be excised [4, 12, 13, 21-26] (**Figure 9**).

We removed 10 of the cysts with this technique foramina monro was narrow inthe 10th case only the left ventricle was large so we introduced to the left ventricle transcallosally by craniotomy, we hardly found left monro, the cyst was settled at the posterior and was covered with ependyma and vascular structure.We enlarged foramina Monro to the posterior interfornicially and removed the cyst totally. Especially in this patient recent memory disturbance, motor aphasia and confusion lasting in 2 months developed. Major advantage of transcallosal approach is lack of important deficit. Memory loss and hemiparesis are rare complications. In cases without hydrocephalus reaching the mass is more easy, visualisation of both Foramino Monros is possible. If the lesion settles more posteriorly as seen in our case interforniceal approach can be prefferred. In this approach septum pellucidum is excised and midline forniceal raphe is identified. Excision is performed between two forniceal body begining from monro to the posterior, if the excision is longer than 1-2 cm memory loss and hemiparesis may develop due to hypocampal commisura trauma [8, 10, 17, 23, 27]. Although our insicion was small probably, ecartation of the ventricule in order to visualise Foramino Monro resulted with aphasia (10th case). Recovery of aphasia in 2 months supports this wiev. Symond [24] also recommends not to use ecartation in ventricle because the genu of the internal capsule lies in the inmediate subepandymal plane in the grove between the head of the caudate nucleus and the thalamus.

The cyst was burried between columna fornics commisura anterior and Foramina Monro in the 11th case (**Figure 10**).

In order to enlarge the front of monro, posterior aspect of anterior commisura can be opened limitedly.

Therefore the cyst of the 11th case was removed totally through a plain incision at midline between monro and anterior commisura (**Figure 11**).

More than 99% of cases with colloid cysts have been reported to occur within the third ventricle, almost all in the anterior half. Rare cases of colloid cysts were reported to occur in the posterior third ventricle and there are individual case reports of colloid cyst in the septum pellucidum, in the vellum inter positum, in the fourth ventricle, intra cerebral (A single case)

and intra sellar (A single case). We did not met a case of colloid cyst resembling the location of our 11th case in literature. Our case had indistinct left hemiparesis and memorial disturbance for 1 month postoperatively.

In transcortical approach excission of conical block of cortex through middle frontal gyrus or entrance to lateral ventricule by linear cerebrotomy, cyst can be delivered from monro. Interforniceal and transchoroidal entrance can not be applied with this approach, if ventricules are not dilated the risk of hemiparesis and epilepsy is high [4, 8, 19, 22, 23, 25].

Endoscopic surgery can be applied but total resection range is lower than trans callosal approach. Stereotactic aspiration can be applied as an urgent approach but reccurrence is known to be often [1, 12, 22, 27-32].

Cyst can be aspirated according to its viscosity [6, 9, 31].

Transcallosal approach is the most successful procedure in cerebrospinal fluid (CSF) obstruction. However, despite the total excision of the cyst, obstruction can persist due to cyst content and spilled blood (**Figure 12**).

Acqueduct stenosis may accompany colloid cyst. Therefore etiology of hydrocephalus must be clarified preoperatively. Mental status changes and memory disturbance are the most common complications of transcallosal operation [1, 2, 31]. These changes were observed in 9 of our patients, we don't know if these changes were present before the operation because none of our patients underwent advanced neuropshchological evaluation. It develops due to the cyst itself or trauma to the fornix or surrounding tissue during the operation. Changes present before the operation becomes obvious following the operation. Cholinergic input flow from basal nucleus to hippocampus is effected in memory loss. Probably, fornical and hippocampal nuclei functions deterioration due to operation. Another cause of memory loss is inferior thalamic pedincle injury lying from thalamus dorso medial nucleus to amygdala. These pathways are related with fornix. Mc Mackin stated that serious memory disturbance will not develop in cases with healty left fornix [19].

Following colloid cyst operation mutism, significant verbal deficit, stupor, obtundation, behavior changes, sectioning information, hyperthermia, hemiparesis, drowsiness, cranial nerve paralysis did not develop in our patients.

In one case we injured vein which was adherent widely to duramater and draining to superior sagittal sinus. Bleeding ceased with coagulation. Focal motor epilepsy dominant at the left arm developed at the postoperative 4th day. CT revealed venous infarct (**Figure 3**), antiepileptic drug was recommended for 1 month, the symptoms were found to be recovered at the 1st month.

Conclusion

Transcallosal, transforaminal, interfornicial approach allows beter visualisation of both Foramina Monros and third ventricle. We can estimate that Transcollosal, transforaminal, interfornicial approach is an easy, safe procedure with low complication and reccurence rate for total resection of 3rd ventricule colloid cysts.

Disclosure of conflict of interest

None.

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