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Colloid Cyst of the Third Ventricle: A Case Series

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ABSTRACT
Colloid cysts represent up to 2% of all intracranial neoplasms. They are benign and usually occur in anterior and antero-superior part of the third ventricle. These cysts frequently obstruct the foramen of Monroe resulting in hydrocephalus which is a neurosurgical emergency. At other times the symptoms may be non-specific like headache, vomiting etc. Many a times, colloid cysts may be completely an incidental finding with patients performing a CT scan for complaints unrelated to the cyst. Recognition of symptoms and a prompt diagnosis using MRI coupled with a proper neurosurgical Intervention is necessary especially in symptomatic patients as these tumors may rarely lead to sudden death. A prospective study of 15 patients with colloid cyst of the third ventricle who underwent surgical management at a single center was conducted. Demographic data, injury characteristics, surgical details and outcomes were analyzed. Endoscopic approach for excision of the tumor was compared with the microsurgical approach. In the present study of 15 patients operated for colloid cyst of the third ventricle 4 patients were male and 11 patients were female. Endoscopic approach carried significantly reduced operating times (p-0.008). The incidence of complications was also significantly reduced in the endoscopic approach which included peri-operative haemorrhage, seizures, memory deficits etc. However, the incidence of residual cyst wall remnants were significantly lower in the microsurgical approach when comparing with the endoscopic approach (p-0.03296).

INTRODUCTION

Colloid cysts are benign intracranial neoplasms which represent up to 2% of all intracranial neoplasms[1-3]. These tumors most commonly occur in the anterior and antero-superior part of the third ventricle[4,5]. The symptoms range from asymptomatic to causing obstruction to the foramen of Monroe causing hydrocephalus[4,6]. The most common symptom, however is a non-specific headache although these lesions may rarely cause sudden death[7]. The cysts are smooth walled, spherical in shape and may vary in size from 3-40 mm, although size does not appear to be a reliable predictor of outcome, as even small ones may result in sudden death[8]. Histologically colloid cysts are lined by simple to pseudostratified epithelium interspersed with goblet cells and scattered ciliated cells. The cysts are composed of PAS-positive amorphous material, sometimes showing necrotic leukocytes or cholesterol clefts or both. Occasionally, chemical irritation resulting from hemorrhage, cholesterol, orthe colloid material itself may give rise to a sec-ondaryxanthogranulomatous reaction within the cyst wall[9].

Radiologically, both CT and MR imaging can be used in diagnosing colloid cysts. On, CT scanning, they are mostly hyperdense with respect to the brain but may occasionally be hypodense or isodense[10]. On MR scans, around 50% of the colloid cysts are hyperintense and the rest are either hypointense or isointense with respect to the adjacent brain parenchyma. On T1 Contrast image, they sometimes demonstrates thin rim enhancement, but usually this represents an enhancement of the adjacent and stretched septal veins[11]. On T2 imaging, most are of low T2/T2* signal (short T2), related to thick motor oil consistency fluid, some have central low T2 and high peripheral T2 signal, some are homogeneously high signal[12,13]. Therefore, treatment of these tumors with neurosurgical intervention is necessary, especially for symptomatic patients, as these tumors can lead to an acute decompensation and rarely sudden death.

Cardiothoracic Neurosciences Centre Guwahati, GMCH, being the only apex body of Neurosurgical care in the Northeastern region of India, today, is at its zenith, receiving patients not only from hinterlands of Assam but also from the other Northeastern states as well as from the neigh bouring countries, downstream of Brahmaputra, like Bangladesh. The Centre provides for a comprehensive and holistic care towards each and every patient in the Department of Neurosciences and till toady stands as a true testimony to its tireless efforts. However, owing to the overwhelming population numbers and being the only apex body in the center of the state, there continues to the be some patient-specific problems of attrition and loss to follow-up. Due to this, in conducting a study, we often haves to reconsider the study population while taking the sample size many a times.

Aims and Objectives:

- To study the clinical features and different approaches of surgical management of colloid cyst of the third ventricle.
- To compare and analyse neurological outcomes and complications of endoscopic versus microsurgical approach for excision of colloid cyst of the third ventricle.

MATERIALS AND METHODS

Study Design and Setting: This prospective case series was conducted at Cardiothoracic and Neuroscience Center, Gauhati Medical College and Hospital, a tertiary care centre specializing in the management of intracranial space occupying lesions. The study was approved by the institutional review board and informed consent was obtained from all participants.

Patient Selection: Patients diagnosed with colloid cyst of the third ventricle who were scheduled to undergo surgical management between September 2023 and August 2024 were screened for eligibility. Patients were identified through the hospital's electronic medical record system and referrals from allied departments.

Inclusion and Exclusion Criteria: Patients were included in the study if they met the following criteria:

- Patients diagnosed on MRI as having colloid cyst of the third ventricle.
- Patients with a Colloid Cyst Risk Score of >4.
- Patients providing consent to undergo surgical intervention.

The Exclusion Criteriae were as Follows:

- Patients diagnosed on MRI as having other lesions of the third ventricle other than Colloid cyst.
- Patients with a Colloid cyst risk score of <2.
- Patients not providing consent to undergo surgical intervention.

Data Collection: Demographic data, injury characteristics, preoperative neurological status, surgical details and postoperative outcomes were collected prospectively. Neurological status was assessed using the Glasgow Outcome Score (GOS)[14].

Table 2: Glasgow outcome scale.

Glasgow outcome scale		
Death	Severe injury or death without recovery of consciousness.	1
Persistent vegetative state	Severe damage with prolonged state of unresponsiveness and a lack of higher mental function.	2
Severe disability	Severe injury with permanent need for help with daily living.	3
Moderate disability	No need for assistance in everyday life. Employment is possible but may require special equipment.	4
Low disability	Light damage with minor neurological and physiological deficits	5

Surgical Management: The decision to perform surgery was based on Colloid Cyst Risk Score (CCRS) and the choice of surgical approach were based on pre-operative MRI findings and surgeon preference. The three types of surgeries that were performed were microsurgical resection via Trans cortical trans ventricular approach orInterhemis pherictrans callosal approach and Endoscopic resection.

Postoperative Care: Postoperatively, patients were managed in the intensive care unit (ICU) with a focus on respiratory support, hemodynamic monitoring and Intracranial pressure (ICP) monitoring.

Follow-Up and Outcome Measures: Patients were followed up at regular intervals (6 weeks, 3 months, 6 months and 1 year) after discharge. Neurological status, functional outcomes and complications were assessed at each follow-up visit.

Statistical Analysis: Descriptive statistics were used to summarize the demographic data, injury characteristics and surgical details. Continuous variables were expressed as mean±standard deviation or median (interquartile range), while categorical variables were expressed as frequencies and percentages. A $p<0.05$ was considered statistically significant. Statistical analysis was performed using SPSS version 29.0.

RESULTS AND DISCUSSIONS

Clinical Features of Patients: During a period of 1 year, 21 patients with colloid cysts were diagnosed at C.N. Center, GMCH. However out of these, 6 patients were diagnosed incidentally with a CCRS <2. 15 of these patients presented with symptoms and was considered for surgical intervention. Mean age at presentation was 47 with a range between 24-72. 11 (73.34%) patients were male and 4 (26.67%) patients were female. The most common symptom was headache (15), followed by nausea and vomiting(9). 4 patients had acute deterioration of consciousness because of acute hydrocephalus for which they underwent emergency shunting procedures. Removal of the colloid cyst was performed later, within a few weeks after recovery of the patients. Table 1 depicts the clinical features with which the patients presented.

Table 1: Clinical Features of Patients with Colloid Cyst of Third Ventricle

Clinical Features	No. Of Patients (n)	Percentage (%)
Headache	15	100
Nausea and Vomiting	9	60
Seizures	8	53.34
Visual Disturbances	4	26.67
Altered Sensorium	4	26.67
Gait Disturbances	3	20
Memory Disturbances	3	20
Incontinence	2	13.34

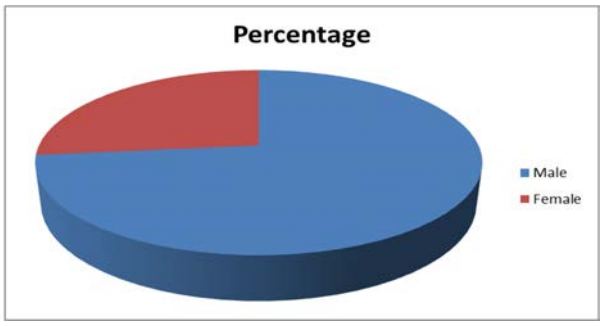

Fig 1: Percentage Sex Distribution of Patients

General characteristics of patients undergoing surgical intervention 4 patients in the current series were managed endoscopically whereas 11 patients were managed using microsurgical techniques namely Interhemispheric trans-callosal approach (IHTC) or Transcortical transventricular approach (TCTV) out of which 4 patients were male and 11 patients were female. The average age in the endoscopic group was 41.2+15.5 years and that in the microsurgical group was 37.5+16.0 years. 4 patients in the microsurgical group had acute hydrocephalus which was managed by pre-operative shunting procedures.

The average operating time in the endoscopic group was 3.0+0.9 hours which was significantly (p-0.008) less than in the microsurgical group which was 5.2+1.3 hours. 1 out of 11 patients in the microsurgery group had residual cyst wall whereas 3 out of 4 patients in the endoscopic group had a residual cyst wall which was significantly (p-0.03296) higher. 1 patient in the endoscopic group had a post-operative EVD procedure whereas 4 patients in the microsurgery group had a post-operative EVD in situ. Length of hospital stay was reduced in the endoscopic group was reduced in the endoscopic group although it was non-significant (p-0.2376). No procedure related deaths were encountered in either group.

Table 2: Characteristics of Patients Undergoing Surgical Intervention

Patient Characteristics	Endoscopic (n-4)	Microsurgical (n-11)
Age (in years)	41.2+15.5	37.5+16.0
Sex(F/M)	1/3	3/8
Cyst diameter (mm)	12.1+4.8	11.8+4.7
Cyst volume (mm3)	2090.0+3144.9	1743+4674.3
Acute Hydrocephalus	0	4

Table 3: Comparison of the Operative Parameters

Parameters	Endoscopic (n=4)	Microsurgery(n=11)	P-value
O.T. time (hours)	3.0+0.9	5.2+1.3	0.008
Residual Cyst Wall (mm)	3 (75%)	1(9.09%)	0.03296
EVD Post-op	1 (25%)	4 (36.36%)	1.00
LOS (days)	4.1+1.9	8.9+7.5	0.2376
Procedure-related death	0	0	-

Neurological Outcome: Glasgow outcome score (GOS) was used to assess the neurological outcome following surgery. 3 out of 4 patients in the endoscopic group had GOS of 3 at discharge., whereas, at 6 months

follow-up 3 patients had GOS of 5 and 1 patient had GOS of 4 with a clear improvement in neurological status. In the microsurgery group, 6 patients out of 11 had a GOS of 3 at the time of discharge, but when followed-up for 6 months there was a clear improvement of neurological status with a non-significant difference from that of the endoscopic group.

Table 4: Neurological Outcome of the Operated Patients.

Follow-Up Time	Glasgow Outcome Score (GOS)					
	Procedure	1	2	3	4	5
Diascharge	Endoscopic	0	0	3	0	1
	Microsurgery	0	0	6	4	1
6 weeks	Endoscopic	0	0	2	1	1
	Microsurgery	0	0	5	5	1
3 months	Endoscopic	0	0	0	3	1
	Microsurgery	0	0	4	5	2
6 months	Endoscopic	0	0	0	1	3
	Microsurgery	0	0	3	2	6

Complications: The complications following surgery included memory deficit, peri-operative haemorrhage, seizures and re-operations either for complications or recurrence. 1 (25%) patient undergoing endoscopic resection was re-operated due to recurrence found out by post-operative scans during follow-up with symptoms and 1(9.09%) patient undergoing microsurgical resection was re-operated due to complication of haemorrhage. Table 4 depicts the various complications encountered during surgery whereas table 5 depicts the factors associated with the complications.

Table 5: Complications and Re-Operation During Resection of Colloid Cyst.

Complication	Endoscopic (n=4)	Microsurgical (n=11)
Memory deficit	0	1
Peri-operative haemorrhage	1	1
Seizures	0	1
Re-operation for complication	0	1
Re-operation for recurrence	1	0

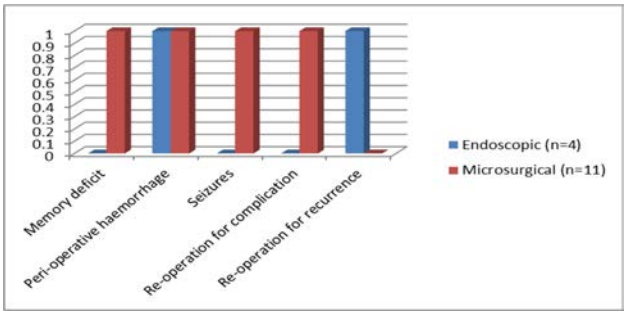

Fig. 2: Comparison of the Various Complications

Factors Associated with Complications: Endoscopic approach had a significantly decreased rate of complications (p-0.0229). Other factors like age, sex, cyst diameter or presence or absence of hydrocephalus although associated with development of complications did not have any statistically significant association in the current study.

Table 6: Factors Associated with Complications

Factors	Complications present (n=6)	Complications absent (n=9)	P-value
Age (years)	43.2+14.7	37.1+16.0	0.517
Sex (F/M)	2/4	2/7	1.000
Cyst diameter (mm)	12.5+6.3	11.8+4.2	0.805
Obstructive Hydrocephalus+	2	2	1.000
Approach (Endo/Micro)	1/4	2/8	0.0229

Fig. 3: Pre-and Post-Operative Scans of a Patient with Perioperative Haemorrhage

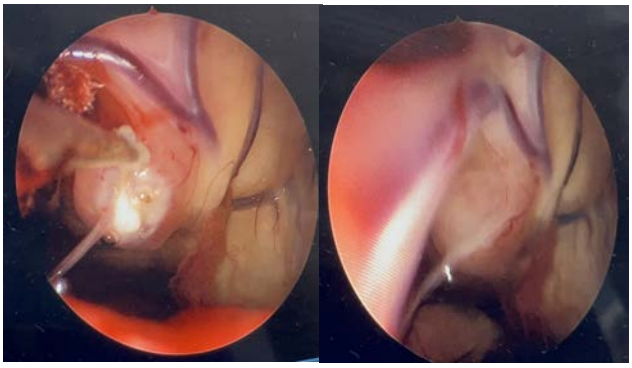

Fig. 4: Intraoperative Findings of a Third Ventricular Colloid Cyst Operated Via Endoscopic Approach

The prevalence of colloid cyst of the third ventricle accounts for 1 in 5 primary intraventricular tumors[15]. However, the incidence rate is thought to be around 0.9[16]. The cysts are usually asymptomatic, however, if they at all become symptomatic, they typically do so in the third to sixth decade of life. Many studies have demonstrated that up to 34% of the patients who become symptomatic have rapid deterioration of sensorium[17].

In the current study, headache was the most common presenting feature (100%) followed by nausea and vomiting (60%). In a similar study conducted by Beaumont[18], they also found a similar presentation of symptomatic patients wherein headache was the most common presenting complain followed by nausea and vomiting[18].

The present compares microsurgical resection of third ventricular colloid cyst with the endoscopic approach based on various parameters. Operating time was significantly (p-0.008) reduced in the endoscopic group when compared to the microsurgical group. This was

consistent with the findings in the study conducted by Grondin[19], wherein they retrospectively compared outcomes of 31 patients who underwent either microsurgical or endoscopic resection of colloid cysts. The current study however, has a significantly increased (p-0.03296) incidence of residual cyst wall and recurrence when treated via an endoscopic approach in comparison to the microsurgical approach. This was consistent with the findings in the study conducted by Kehler[20], wherein they compared 20 patients of third ventricular colloid cysts treated either endoscopically or microsurgically.

Perioperative haemorrhage was the most common complication in the present study (n-2) which distributed equally among the two surgical groups. However, other complications like seizures, memory deficit etc. were encountered only in the microsurgical group. In an analysis of an administrative claims database, they suggested similar complication profiles between the endoscopic and microsurgical approaches, although total admission costs and aggregated 90-day postdischarge costs were significantly greater for microsurgically treated patients experiencing $\geq$1 complication, suggesting that these patients had more severe complications[21]. The current study has also attempted to analyse the factors associated with the various complications . Age was an insignificant predictor of complications as was sex, however after accounting for other contributory factors, surgical approach was the only independent predictor of complications with an endoscopic approach significantly reducing the rates of complications (p-0.0229) in the present study. In contrast, endoscopic resection was associated with a significantly increased frequency of residual cyst wall remnants in the present study. Until the recurrence risk is better understood, any patient with a residual cyst wall remnants must be followed with yearly surveillance imaging for at least a decade.

CONCLUSION

Colloid cyst of the third ventricle poses a rare but a unique challenge to the neurosurgeon. Both the approaches for its resection has its own pros and cons. Endoscopic resection of colloid cysts of the third ventricle is associated with a marked reduction in perioperative complications when compared to microsurgical resection and is a cost effective approach, more so in the setting of complications. However, this approach has an in increased likelihood of coagulated cyst wall remnants compared to microsurgical resection. Whatever be the approach, early detection and total excision offers a permanent cure to the patients harbouring colloid cyst of the third ventricle.

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