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Research Paper

Comparative Outcomes of Transcallosal Microsurgical and Endoscopic Approach for Colloid Cyst Removal: A Single-Center Retrospective Analysis

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ABSTRACT:

BACKGROUND:

The operating microscope is a now a must in complex neurosurgical interventions. Endoscope allows neurosurgeons to reach areas in the brain through minimally invasive approaches.

OBJECTIVE:

Colloid cysts in the third ventricle are benign intraventricular tumors, with surgical treatment often recommended. This study compares the outcomes of endoscopic transcortical and microscopic transcallosal approaches for colloid cyst removal.

PATIENTS AND METHODS:

A retrospective analysis of 22 patients (15 males, 7 females) who underwent colloid cyst resection which was performed between March 2012 and December 2018. Patients underwent either a transcallosal approach (14 patients) or an endoscopic approach (8 patients).

RESULTS:

Complete resection was achieved in 85% of transcallosal cases and 25% of endoscopic cases. Complications were fewer in the transcallosal group, with two patients experiencing memory loss and disconnection syndrome. The endoscopic group had more complications, including left-side weakness, dysarthria, and CSF leak. Surgery duration was shorter for the transcallosal group (2.5 hours) than the endoscopic group (3.25 hours). Glasgow outcome scale results favored the transcallosal group.

CONCLUSION:

Our study demonstrated that total resection was more common in transcallosal surgery, which also had better Glasgow outcome scale results, shorter surgery times, and reduced hospitalization durations.

KEYWORDS: Colloid Cyst, Transcallosal Microsurgical Approach, Endoscopic Approach.

FICMS, Neurosurgery teaching hospital, Neurosurgery teaching hospital.

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INTRODUCTION

Colloid cysts in the third ventricle are relatively rare, accounting for 0.3-2% of all brain tumors (1-4) and 15-20% of intraventricular tumors. These cysts are considered benign, non-invasive, and congenital in nature. Colloid cysts can manifest at any age but are seldom reported in childhood or early adolescence [(2)]. They are most commonly symptomatic between the ages of 20 and 50. Many colloid cysts are asymptomatic and discovered during CT or MRI scans for unrelated issues.

Many neurosurgeons are hesitant to pursue conservative management of colloid cysts and often recommend surgical treatment for asymptomatic colloid cysts, especially in young and healthy patients [(1,3,7)]. Open operative techniques allow removal of the cyst wall and contents, direct hemostasis, and pellucidotomy. Various open surgical approaches have been developed for these tumors.

The transcallosal approach carries a risk of venous infarction associated with dividing large bridging cortical veins that drain into the superior sagittal sinus and prolonged cortical retraction [(3,8)]. However, with proper microsurgical techniques, these complications can be minimized. The transcortical approach is primarily used in endoscopically assisted minimally invasive open resections. The primary drawback of the endoscopic procedure is that removing the entire colloid cyst wall often necessitates significant traction, increasing the risk of hemorrhage.

This study compares the endoscopic transcortical and microscopic transcallosal approaches for colloid cyst removal.

PATIENTS AND METHODS:

We conducted a retrospective analysis of patients who had colloid cyst resection in a neurosurgical teaching hospital between March 2012 to December 2018. 22 patients were included in the study (15 males and 7 females). Age at the time of presentation was from 21 to 55 years (mean age was 36.5 years), and the most common presentation was headache (68.2%), with brain CT scan showing hydrocephalus in 6 patients (27.3%) in all those 6 patients had CSF diversion prior to colloid cyst surgery. Each patient had either an interhemispheric transcallosal approach 14 patients (5 males, 9 females) or an endoscopic approach 8 patients (6 males, 2 females) (65% transcallosal, 35% endoscopic).

The transcallosal approach is made through midline craniotomy, as described by APPUZO et al., with preservation of the bridging veins; the whole procedure is done microscopically from the dural opening to its closure.

The endoscopic procedure is done through a linear incision centered on the coronal suture. Gaab set is used with rigid for working and exploration at the end of the procedure. All patients had undergone a brain CT scan, brain MRI pre-operatively, and a follow-up brain CT scan on the first post-operative day and brain MRI arranged post-operatively.

Statistical analysis:

The normal distribution of the data was assessed with the Shapiro-Wilk test. Descriptive statistics were done for all variables, with mean and standard deviation for continuous variables (Age, lesion size, duration of surgery, and duration of hospital stay). Comparison between trans-callosal and endoscopic approaches. An Independent t-test was used to show the differences between studied variables (continuous one) with surgical approaches (Transcallosal vs. endoscopic). Fisher and Mann-Whitney U test was used to show the associations between studied variables (categorical ones) with surgical approaches. All graphs were designed using Microsoft word office 2010, and all Statistical analyses were performed using SPSS Statistics (version 25, IBM) at a level of significance ($P < 0.05$) with confidence intervals of 95%.

RESULTS:

The surgeon determined whether to perform a transcallosal or endoscopic procedure depending on the indications mentioned previously and the physician's experience. All of the colloid cysts were found in the third ventricle's roof, close to the foramen of the monro.

Nearly all of the cases (85%) in the transcallosal group achieved complete resection of the colloid cyst (content and wall). In the endoscopic group, entire resection was accomplished in 25% of the cases, while subtotal resection was practiced in 62.5 percent of the cases.

Except for two patients (2/14 patients), who experienced memory loss and disconnection syndrome, there were no complications in the transcallosal group. In the endoscopic group, complications were recorded more in this group including (left side weakness, dysarthria, and CSF leak) which was in 4/8 patients (Table 1). Regarding the density of the colloid cyst on native brain CT scan, in the transcallosal group, all cases but one was hyperdense on CT scan, on the contrary, all cases but two were hypodense; this was considered to be an important indication for the surgery. In regard to the duration of surgery, there was a difference in the two groups, which was less in the transcallosal group: 2.5 hours as a median time for the transcallosal and 3.25 hours in the endoscopic group (Table 2).

The duration of hospital was less in the transcallosal group than the endoscopic group, 4 days for the transcallosal VS. 6 days for the endoscopic. The Glasgow outcome scale was an important indicator in the follow-up of the patient post-operatively, all patients showed GOS 5 in the transcallosal group, while two patients were GOS 4 and another one was GOS 1 in the endoscopic group (Table 3,4).

Table 1: Patient Characteristics and Outcomes comparison.

		Transcallosal		Endoscopic	
Variables	**Categories**	**N**	**%**	**N**	**%**
Sex	Male	9	64.3%	6	75%
	Female	5	35.7%	2	25%
Presentation	Headache	8	57.1%	7	87.5%
	Drowsiness	1	7.1%	0	0%
	Loss of consciousness	1	7.1%	0	0%
	Vomiting	2	14.3%	1	12.5%
	Papilledema	1	7.1%	0	0%
	Gait disturbance	1	7.1%	0	0%
CT: Hydrocephalus	No	10	71.4%	6	75%
	Yes	4	28.6%	2	25%
Pre-op. CSF diversion	No	10	71.4%	6	75%
	Unilateral Shunt	1	7.1%	1	12.5%
	Bilateral Shunt	2	14.3%	1	12.5%
	Temporary EVD	1	7.1%	0	0%
CT: hyper dense vs. hypo dense	No	1	7.1%	6	75%
	Yes	13	92.9%	2	25%
Post op. shunt	No	8	57.1%	4	50%
	Unilateral Shunt	4	28.6%	3	37.5%
	Bilateral Shunt	2	14.3%	1	12.5%
Extent of resection	Subtotal	2	14.3%	5	62.5%
	Total	12	85.7%	2	25%
	Cyst evacuation	0	0%	1	12.5%
Post op. complications	No	12	85.7%	4	50%
	Disconnection syndrome	1	7.1%	0	0%
	Memory disturbance	1	7.1%	0	0%
	CSF leak	0	0%	1	12.5%
	Left side weakness	0	0%	2	25%
	Dysarthria	0	0%	1	12.5%
Glasgow outcome scale	1	0	0%	1	12.5%
	4	0	0%	2	25%
	5	14	100%	5	62.5%

Table 2: Comparison between Transcallosal vs. endoscopic approaches regarding key metrics.

Variables	**Min**	**Max**	**Mean**	**SD**	**Median**
Transcallosal approach					
Age	21	55	36.64	10.602	38
Lesion size/mm	9	29	15.71	7.151	12
Duration of surgery/hours	2	4	1.679	0.774	2.5
Duration of hospital stay/days	3	5	3.93	0.829	4
Endoscopic approach					
Age	20	48	36.38	9.456	38.5
Lesion size/mm	10	29	17.75	7.778	14.5
Duration of surgery/hours	2	4.5	3.188	1.032	3.25
Duration of hospital stay/days	4	9	6	1.852	5.5

Table 3: Differences between key outcome variables with surgical approaches (Transcallosal vs. endoscopic).

Variables	Md.	Upper limit	Lower limit	P-value
Age	0.268	-9.176	9.712	0.953
Lesion size/mm	2.036	-8.856	4.784	0.541
Duration of surgery/hours	1.508	0.7010	2.3168	0.001**
Duration of hospital stay/days	2.071	0.645	3.498	0.016*
*Statistically significant at p≤0.05 ** statistically significant at p=0.001 Md.: Mean difference				

Table 4: Association categorical variables with surgical approaches (Transcallosal vs. endoscopic).

Variables	Test value	P-value
Sex	0.269	0.490
Presentation	2.986	0.702
CT: Hydrocephalus	0.033	0.631
Pre op. CSF diversion	0.753	0.861
CT: hyper dense vs. hypo dense	10.805	0.002*
Post op. shunt	0.187	0.911
Extent of resection	8.418	0.015*
Post op. complications	9.036	0.108
GOS	6.079	0.048*
*Statistically significant at p≤0.05 ** statistically significant at p=0.001		

DISCUSSION:

There are no universally accepted guidelines for selecting a surgical approach; the choice often depends on surgeon preference and experience (9-12). In the current study, we aimed to delineate the differences between transcallosal microsurgical and endoscopic transcortical approaches.

We included 22 patients in our study (14 underwent transcallosal surgery, and 8 underwent endoscopic surgery). The difference in patient numbers is due to the surgeons' experience and preference. Most cases were male (64.3% in the transcallosal group and 75% in the endoscopic group), differing from Horn et al.'s [15] study (48% transcallosal and 50% endoscopic). This discrepancy may be attributed to the small number of cases in our study.

In terms of hydrocephalus, only 4 patients (28.6%) in the transcallosal group had hydrocephalus on a CT scan, and all of them received CSF diversion, with 2 additional patients receiving post-operative CSF diversion (42.9%). In the endoscopic group, 2 patients had hydrocephalus and CSF diversion (25%), with 2 more patients receiving post-operative CSF diversion (50%). These percentages were considered high compared to Horn et al.'s study, where only 17 out of 27 patients in the transcallosal group and 17 out of 28 patients in the endoscopic group had hydrocephalus, with only 5 and 2 patients receiving VP shunts, respectively (15). We also counted the cases that had total removal of the colloid cyst, 12 patients (85.7%) had total removal in the transcallosal group, with only 2 patients (25%) in the endoscopic group; these results were similar compared with HORN et al. 16/17 patients 94% in the transcallosal group and 10/19 53% [15]. In our study we had 4 cases out of 14 with hydrocephalus and underwent transcallosal surgery, on the other hand only 2 cases out of 8 had hydrocephalus and went for endoscopic resection. When we compare post-operative state regarding hydrocephalus, 6 cases needed ventriculoperitoneal shunt in transcallosal approach and 4 cases had ventriculoperitoneal shunt in endoscopic approach.

We also assessed cases where the colloid cyst was entirely removed: 85.7% of patients in the transcallosal group and 25% in the endoscopic group, results similar to Horn et al.'s study (94% transcallosal and 53% endoscopic). The colloid cyst's appearance on a CT scan and its content

are essential indicators for surgical decision-making. Thick, hyperdense content is often considered challenging for endoscopic surgery, as partial resection was achieved in 2 cases in our series. In a comparable study performed by Kondziolka et al. [8], eleven cases had total removal in the transcallosal approach which is nearly the same result as ours.

A significant difference is observed in the duration of surgery between endoscopic and transcallosal approaches. For those who underwent transcallosal surgery, the procedure typically lasted between 2 to 4 hours, with an average time of 2.6 hours. In contrast, endoscopic surgery had a longer duration, ranging from 2 to 4.5 hours and averaging 3.18 hours. This difference is highly significant in our study and notably different from the findings of Horn et al., who reported an average duration of 3 hours for endoscopic surgery and 4.45 hours for transcallosal surgery [15]. This discrepancy can be attributed to intraoperative complications that may occur during endoscopic surgery, which are not as quickly managed as those encountered during transcallosal surgery. Another factor is the experience of the surgeon in endoscopic or transcallosal approach that might increase or decrease the duration of the surgery.

Furthermore, the duration of hospital-stay also emerged as a distinguishing factor when comparing endoscopic and transcallosal surgeries. The hospital-stay for transcallosal surgery ranged from 3 to 5 days, while for endoscopic surgery, it spanned from 4 to 9 days. In contrast, Horn et al. reported a hospital stay of 6.3 days for transcallosal surgery and 5.4 days for endoscopic surgery. This discrepancy might be attributed to the higher incidence of post-operative complications in the endoscopic group, which stood at 50%, compared to just 14% in the transcallosal group [15]. In the center in which the study took place there were more surgeons who had experience in transcallosal approach than the surgeons with endoscopic approach, that is considered a main factor in the selection of approach and also affect the outcome of the patients.

One of the limitations of this study is that it is a retrospective analysis with a relatively small sample size of 22 patients. This may affect the generalizability of the findings and introduce selection bias, as the choice of surgical approach depended on the surgeon's preference and experience. A larger, randomized controlled trial would provide more robust evidence regarding the differences between transcallosal and endoscopic approaches for colloid cyst removal.

CONCLUSION:

In conclusion, our study examined the differences between transcallosal and endoscopic surgeries, highlighting the importance of colloid cyst density on CT scans in surgical decision-making. We found that total resection was more common in transcallosal surgery, which also had better Glasgow outcome scale results. However, endoscopic surgery had longer surgery times and increased hospitalization durations.

RECOMMENDATION:

Training on the operating microscope to be confident about the surgical anatomy and anatomical landmarks for transcallosal approach. Training on the endoscope and its tools. CT and MRI are essential in determining the approach for colloid resection. The use of CUSA is mandatory to solve the problem of the thick large colloid cyst.

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