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Endoscopic Management of Supratentorial Ventricular Tumors

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ABSTRACT

Background: Intraventricular tumors are ideal indications for neuroendoscopic surgery. Because intraventricular tumors often cause cerebrospinal fluid (CSF) pathway obstruction, resulting in ventricular dilation and sufficient space for maneuvering with the endoscopes is available.

Objective: The aim of this study was retrospectively and antrospectively evaluation of the role and outcome of use of endoscope in intraventricular tumors in term of: 1-Diagnostic of the deep lesions. 2- Management of increased intra-cranial pressure (ICP). 3-Excision of tumor depends on the type.

Patients and Methods: This prospective and retrospective study was carried on 30 patients who sought medical advice for intra ventricular tumor from 2015 to 2019 in Al-Hussein University Hospital. Tumors are removed or biopsied with or without ETV and septum pellucidostomy.

Results: According to our study, we found that endoscopic removal of intraventricular tumors has low rate of complications. There were 25 cases with no complications (83.3%) and better outcome. There were 15 cases (50%) very good outcome and 10 cases (33.3%) were good outcome, as there was minimal dissection and brain retraction.

Conclusion: Regarding endoscopic treatment of intra ventricular tumors, there are many advantages of the endoscopic approach as low rate of complications, minimal dissection, better outcome, brain retraction, rapid access to the target and excellent visualization of the lesion and surrounding structures. Endoscopic approach also has the ability of treatment of the associated hydrocephalus at the same session with low rate of failure or recurrence.

Keywords: Endoscopic Management, Supratentorial ventricular tumors, ETV, SCF.

INTRODUCTION

Intraventricular tumors are ideal indications for neuroendoscopic surgery. These lesions can easily be approached with the endoscope through the ventricular system. Moreover, because intraventricular tumors often cause cerebrospinal fluid (CSF) pathway obstruction resulting in ventricular dilation, sufficient space for maneuvering with the endoscopes is available. However, even in patients with narrow ventricles, the lesions may be approached accurately and safely with the aid of neuronavigation [1, 2].

The aims of endoscopy in intraventricular tumors are usually the restoration of CSF pathway obstruction, clarification of the histology, and if possible, a complete tumor removal [3]. Advantages of the endoscopic approach compared with microsurgical resection are an improved visualization and illumination in the depth of the ventricles as well as less brain tissue dissection and retraction [3].

Craniotomies can be avoided because endoscopes are inserted through simple burr holes. Working through an operative sheath protects the surrounding structures such as fornix, hypothalamus and vessels. Initially, endoscopic tumor surgery was limited to tumor biopsy, mostly performed after an endoscopic third ventriculostomy (ETV) in patients presenting with tumor-related obstructive hydrocephalus [4].

Another alternative procedure in management of ventricular tumors is stereotactic biopsy procedure. But it has high risk of sampling error because migration of tumor from target after puncture of ventricle and (CSF) drainage. It never contributes to treat obstructed hydrocephalus. Symptoms and sign are related to non-communicated hydrocephalus in majority of patients with these tumors. For instance 90% of the patient's with pineal region tumors clinically present with hydrocephalus [5]. Hydrocephalus should be treated beside tumor. One of treatment options is ventriculoperitoneal shunting (VP shunting). But it contributes to dissemination of some tumors such as pineoblastoma and germ cell tumors in to peritoneal cavity [6].

The deep location of intraventricular tumors makes the microsurgical approach difficult. In these tumors, endoscopic procedures are continually gaining importance in neurosurgery, especially because many of these intraventricular tumors do not require aggressive removal [7].

AIM OF THE WORK

The aim of this study was retrospectively and antrospectively evaluation of the role and outcome of the use of endoscope in intraventricular tumors in term of: 1-Diagnostic of the deep lesions, 2-Management of increased ICP and 3-Excision of tumor depend on type.

PATIENTS AND METHODS

Study participants:

This prospective and retrospective study was carried on 30 successive patients who sought medical advice for intra ventricular tumor from 2015 to 2019 in Al-Hussein University Hospital. Tumors are

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removed or biopsied with or without ETV and septum pellucidostomy.

Written informed consent:

An approval of the study was obtained from Al- Azhar University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of the operation.

The following items were completed for each patient:

A. Complete medical history including:

1) Personal History

2) The complaint

- Headache and any manifestations of increased intra cranial tension.
- Symptoms described
- History of present illness
- Past history: History of previous operation.

B. Clinical Findings:

1) Assessment of **general condition** of the patient.
2) Assessment of **surgical fitness**.
3) **Neurological examination**:

C. Radiological investigations: Preoperative brain CT scans and MRI have been done for all the patients to demonstrate the site, size, presence of hydrocephalus, associated intracranial hemorrhage or infarction.

D. Surgical Procedures:

Operative technique used in this study

GAAB and LOTTA rigid endoscopic systems were used (Karl Storz, GmbH, Tutlingen, Germany) for intraventricular visualization, the classic technique of ETV, cyst fenestration, cyst removal, tumor biopsy were used. We carry out 26 cases right sided Kocher Burr Hole, four cases left sided burr hole

External ventricular drain was left in three cases (two central neurocytoma and one metastatic adenocarcinoma) for the following reasons:

1- For measuring of the intracranial pressure, usually left closed

2- Safe guard against acute hydrocephalus and sudden death.

Operative Technique

After general anesthesia was induced, the patient was placed supine with the head in the neutral position on a doughnut pillow. The head is then elevated approximately 30° to minimize excessive CSF loss and entry of air.

A coronal burr hole is placed 3 cm lateral to the midline and just anterior to the coronal suture "Kocher Burr-hole" in pineal region tumors burr hole anterior to usual site 3 cm.

The burr hole, which is 12 to 16 mm in diameter is created on the side of the normal foramen of Monro, larger lateral ventricle, or right side. The dura mater is then opened in a cruciate fashion and the edges are coagulated. The endoscope sheath is then used to cannulate the lateral ventricle. The sheath is directed backwards towards the tragus of the ear in the sagittal plane and to the ipsilateral inner canthus in the coronal plane to lie just within the lateral ventricle .The trocar is then removed to ensure the proper placement into the ventricular system. The advantages of this sheath includes a pathway for irrigation fluid or CSF, and repeated passage of the endoscope without traction on or injury to the brain.

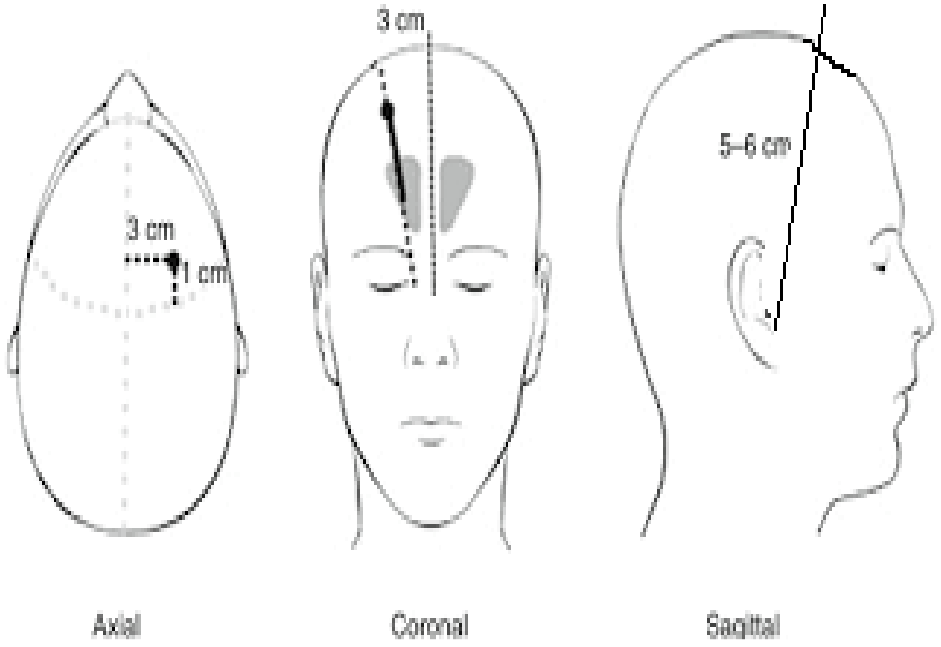


Figure (1): Trajectory of endoscope

Over drainage of CSF and entry of air in the ventricles and subdural space are avoided, especially in large ventriculomegaly. Loss of CSF may also be a risk factor for post-operative subdural hematoma.

The foramen of Monro is at a mean distance of 6 cm from the dura mater via this coronal approach in an adult and less than that in children. The surgeon must be aware of the sheath length during cannulation of the ventricle. The endoscope was passed through the sheath and the lateral ventricle is visualized. The twelve o'clock position can easily be marked on the endoscope to assure proper orientation. The foramen of Monro is identified by the confluence of thalamo-striate vein (laterally), septal vein (medially) and the choroid plexus (posteriorly).

Endoscopic third ventriculostomy (ETV):

The scope is navigated into the third ventricle. The floor of the third ventricle is, on average, 9 cm from the dura mater, but this is highly variable depending on age and extent of hydrocephalus. The mammillary bodies and infundibular recess are identified in the attenuated floor. It is often possible to see the basilar artery posteriorly and the dorsum sellae anteriorly through the thinned floor of the third ventricle. In this situation, the surgeon should be aware that the intended fenestration should be anterior to the basilar artery and behind the dorsum sellae. Position of dorsum sellae could be identified by gentle probing by the blunt instrument, such as bipolar forceps.

The fenestra is performed between the tuber cinerium anteriorly and the mamillary bodies posteriorly either by coagulation or direct puncture, a No. 3 French Fogarty balloon catheter is advanced through the opening in the floor, inflated to widen the newly created aperture. This maneuver widens the fenestration to a width of approximately 5 mm. The scope is then carefully advanced into the prepontine cistern. Any arachnoid bands or imperforate membrane of Liliequist that seem to be impeding the free flow of CSF are bluntly disrupted with the Fogarty catheter. Aggressive exploration of the prepontine cistern is avoided for fear of injuring any perforating or branching arteries. After the stoma is created, the to and fro oscillations of the ventricular floor (whirl sign) indicate good CSF communication between the ventricles and subarachnoid space.

If any hemorrhage is encountered during the procedure, copious warm fluid irrigation is used until all bleeding is visibly stopped and the ventricular CSF is clear. Careful intermittent closure of outflow channel is used to elevate the intraventricular pressure to tamponade the source of bleeding.

At the completion of the fenestration, the endoscope and sheath are removed and any bleeding, from cortical surface if seen while the endoscope was removed, is cauterized. Gelfoam is then placed in the burr hole.

The lamina terminalis is an alternative site for fenestration, but this is located more anteriorly and superiorly in the third ventricle. It is essential that the third ventricle is enlarged and the floor is translucent to avoid injury to neural and vascular structures, specifically the hypothalamus and basilar artery.

Neuroendoscopic Technique for Removal of Colloid Cyst:

Colloid cysts are the ideal tumors for neuroendoscopic removal except of some limitations:

(1) The content of the cyst may be very thick and as a result make the removal difficult.

(2) The cyst may be firmly attached to the ventricular walls and the ventricular veins, requiring careful dissection.

(3) A part of the cyst may be hidden under ventricular structures and have a difficult identification.

Preoperative intravenous corticosteroids are administered to reduce the potential risk of chemical ventriculitis and subsequent hydrocephalus that may occur as a result of intraventricular spillage of colloid material. Seizure prophylaxis is not routinely used. The cyst is exposed, coagulated, and punctured and the content aspirated. When possible, the cyst capsule is coagulated at its attachment site, which is then sectioned or carefully pulled out with a forceps to attempt total removal.

Neuroendoscopic septostomy (NESS):

Indications:

NESS is indicated in patients with isolated monoventricular hydrocephalus due to unilateral obstruction of the foramen of Monro associated with distorted intraventricular anatomy landmarks of the effaced foramen and thus expected risky. If both foramina of Monro are occluded and septum pellucidum is intact, NESS is preferable to bilateral foraminoplasty because the former procedure is technically easier and the latter has the risk of bilateral fornix injury.

Operative technique:

NESS could be performed as a single procedure or simultaneously with bilateral foraminoplasty. In cases indicated for NESS alone, the burr hole is usually positioned in front of the coronal suture and 5–6 cm of the midline, ipsilaterally to the enlarged ventricle. Usually, the septostomy is performed bluntly in a thin avascular part followed by balloon dilatation.

The eventual bleeding from septum pellucidum vessels could be controlled by continuous irrigation or by bipolar cautery. The resulted communication between both lateral ventricles must be wide enough to reduce the risk for reocclusion.

Tumor Biopsy:

Endoscopic tumor biopsy is of particular importance in patients in which the overall oncologic management may not require an aggressive or total tumor removal. Thus, a patient in whom the potential diagnosis includes a germ cell tumor, infiltrative hypothalamic/optic pathway glioma, and Langerhans cell histiocytosis would be an ideal candidate for a minimally invasive endoscopic diagnostic sampling.

Once the tumor is visualized, cupped biopsy forceps are used to sample the tumor. Sites of sampling are chosen that most likely represent pathologic tissue, are relatively avascular, and require as little torque as possible. The small samples of tissue obtained with cupped forceps are challenging for accurate pathologic interpretation, and every attempt should be made to minimize artifact from electrocautery. Therefore, the use of coagulation on the tumor surface, as logical as that may seem, should be avoided prior to sampling. Varying degrees of venous hemorrhage invariably occur with cupped biopsy forceps. This degree of hemorrhage will typically be controlled with continuous irrigation, balloon tamponade, or electrocautery. The number of samples should be governed by frozen specimen interpretation and no more tissue than is absolutely necessary is taken in an effort to reduce intraventricular hemorrhage.

Simultaneous tumor biopsy and endoscopic third ventriculostomy:

The prominence of pineal region tumors in children with noncommunicating hydrocephalus with a pineal region tumor should always be considered for primary endoscopic management by way of ETV and tumor biopsy.

The optimal trajectory for ETV (coronal entry) and pineal region tumor biopsy (frontal-precoronal entry) typically, a combined approach through a single burr hole mandates that the entry site be located midway between the optimal entry sites for either separate procedure.

When performing simultaneous ETV and tumor biopsy, it is preferred to perform the ETV prior to tumor biopsy. This order is advocated since the most pressing clinical condition of noncommunicating hydrocephalus should be definitively addressed prior to any visual potential obscuration by hemorrhage that invariably occurs with tumor biopsy. Thus far, the hypothetical concern of tumor dissemination from the intraventricular compartment to the subarachnoid space following this simultaneous procedure has not been supported by retrospective clinical series.

Radiological assessment:

The radiological assessment **(brain CT and MRI)** of the patients were performed immediate after surgery, one month, two months and four months after surgery for assessment of patient's lesions recurrence for total removed lesions, hydrocephalus and patency of the ventriculostomy.

E. Assessment of complications if present such as:

- *Wound infection*
- *Memory impairment,*
- *Increased degree of hemiparesis,*
- *C.S.F leakage*
- *Bloody tumor intraoperative, not controlled,*
- *Death.*

Statistical analysis

Recorded data were analyzed using the statistical package for social sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean ± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

The following tests were done:

- Independent-samples t-test of significance was used when comparing between two means.
- Chi-square (x^2) test of significance was used in order to compare proportions between two qualitative parameters.
- The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p-value was considered significant as the following:
- Probability (P-value)

- P-value < 0.05 was considered significant.
- P-value < 0.001 was considered as highly significant.
- P-value > 0.05 was considered insignificant.

RESULTS

30 patients presented to Alhussin University Hospitals with intraventricular tumors during the period from 2015 to 2019.

Age & sex:

The age ranged between 6 months and 77 years with a mean of 29.22 ± 21.6 **(**table 1)

Regarding sex**;** sixteen patients were males (53.3%) and fourteen were females (46.7%) as shown in t**able (1).**

Table (1): Distribution of the studied cases according to demographic data (n= 30)

	No.	**%**
Age (years)		
<30	18	60.0
≥30	12	40.0
Range	0.50 – 77.0	
Mean ± SD.	29.22 ± 21.6	
Median	22.5	
Sex		
Male	16	53.3
Female	14	46.7

Regarding procedure done for the studied cases: There were 12 cases totally excised, 2 of them excision was done without ETV, 9 of them excision was done with ETV as there was hydrocephalus and one of them excision was done with ETV and septostomy. There were 18 cases biopsy was done, 2 of them biopsy only without any other procedure, 11 of them biopsy was done with ETV, 2 of them biopsy was done with EVD, one of them biopsy was done with VP shunt, one of them biopsy was done with EVD and ETV and the last one biopsy was done with ETV and VP shunt as shown in table (2).

Table (2): Distribution of the studied cases according to procedure (n= 30)

Procedure		No.	%
Excision	Total	12	40%
	Excision only	2	6.7%
	Excision and ETV	9	30%
	Excision and ETV and septostomy	1	3.3%
Biopsy	Total	18	60%
	Biopsy only	2	6.7%
	Biopsy and ETV	11	36.6%%
	Biopsy and EVD	2	6.7%
	Biopsy and shunt	1	3.3%
	Biopsy and ETV and EV	1	3.3%
	Biopsy and ETV and VP shunt	1	3.3%

Pathological finding:

Regarding pathological finding of the tumor, there were 10 cases (33.3%) colloid cyst, 3 cases (10%) were low grade glioma, 3 cases (10%) were central neurocytoma, 2 cases (6.7%) were astrocytoma, 2 cases (6.7%) were choroid plexus papilloma, 2 cases (6.7%) were metastasis, 1 case (3.3%) was germ cell tumor, 2 cases (6.7%) were craniopharyngeoma , 1 case (3.3%) was teratoma, 1 case (3.3%) was meningioma, 1 case (3.3%) was ependymoma, 1 case (3.3%) was choroid plexus carcionoma and one patient's pathological report revealed no tumor as shown in table (3).

Table (3): Distribution of the studied cases according to pathological finding (n= 30)

Pathological finding	No.	%
Colloid cyst	**10**	**33.3**
Low grade Glioma	3	10.0
Central neurocytoma	3	10.0
Astrocytoma	2	6.7
Choroids plexus papilloma	2	6.7
Metastasis	2	6.7
Germ cell tumor	1	3.3
Craniophayngeoma	2	6.7
No tumor	1	3.3
Teratoma	1	3.3
Meaningeoma	1	3.3
Ependynomous	1	3.3
Choroids plexus carcinoma	1	3.3

Complications:

There were 25 cases with no complications (83.3%), one patient complaining of post-operative mild memory impairment, one patient complaining of increased degree of hemiparesis, one patient complaining of C.S.F leakage and VP shunt was inserted and 2 cases had bloody tumor intraoperative that was not controlled and they died (table 3).

Table (3): Distribution of the studied cases according to complication (n= 30)

Complication	No.	%
No	**25**	83.3
Bloody not controlled	2	6.6
Post-operative mild memory impairment	1	3.3
Increase degree of Hemi paresis	1	3.3
C.S.F. leakage	1	3.3

Post-operative outcome:

According to modified Rankin scale, there were 15 (50%) cases very good outcome, 10 cases (33.3%) were good outcome, 3 cases (10%) were poor outcome and 2 cases (6.7%) died, which was statistically significant.

Table (4): Distribution of the studied cases according to post-operative outcome (n= 30)

Complication	No.	%
Very good	**15**	**50%**
Good	10	33.3 %
Poor	3	10%
Died	2	6.7%

Case presentation

CASE 1 (germ cell tumor)

Male case 15 years old complaining of headache, gait disturbance and six CN palsy. Past history by his mother of scrotal swelling since three years that relieved by chemotherapy. MRI brain showed pineal region tumor with cystic component occluded the opening of aqueduct of sylivus (AS) and causing hydrocephalus.

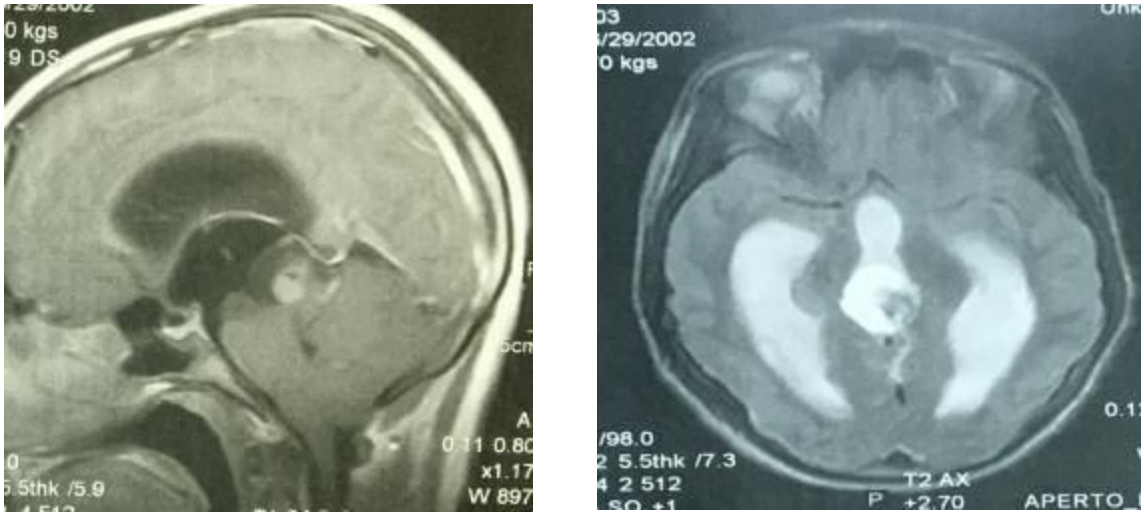


Figure (2): MRI pre-operative in germ cell tumor

Pre-operation sample of alpha fetoprotein and HCG were tested, which showed high result. Case was planed for ETV, CSF sample and tumor biopsy

Figure (3): Endoscopic tower and position

Operative technique

After induction of general anesthesia, case was placed in supine position with head elevated 30 degree mark on mid line and coronal suture Rt side linear skin 1st burr hole 1 cm pre coronal for ETV. After introduce endoscope identification foramen of Monoro, TSV and septal vein and CSF for analysis of tumor seeding then introduced into 3rd ventricle to see optic chiasma, infundibulum, tuber cinerium and mammillary body. At pre mammillary recess site of stoma by grasping forceps and wide stoma by ballooning. Then inspection of pre pontine cistern no adhesion presented.

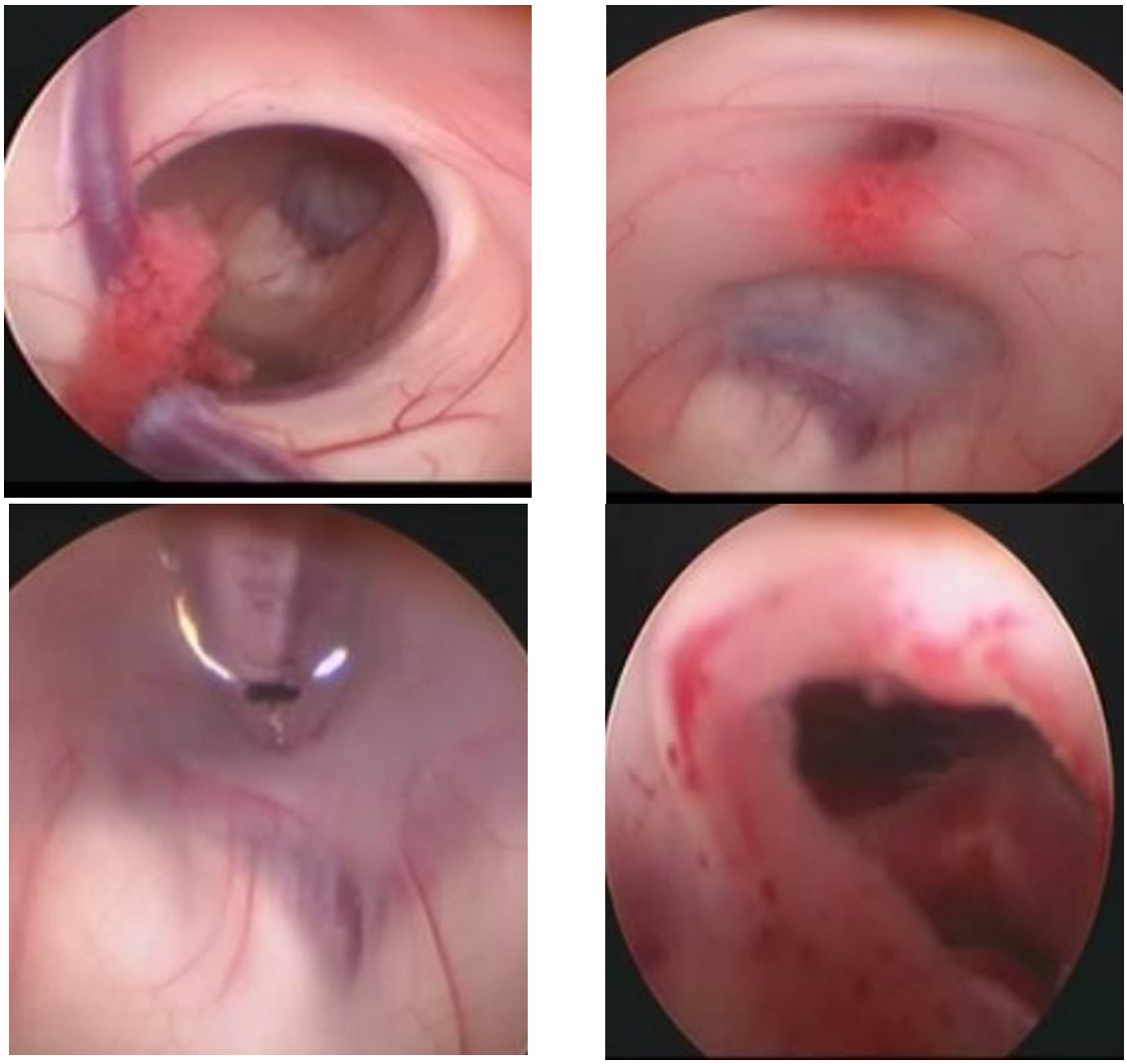
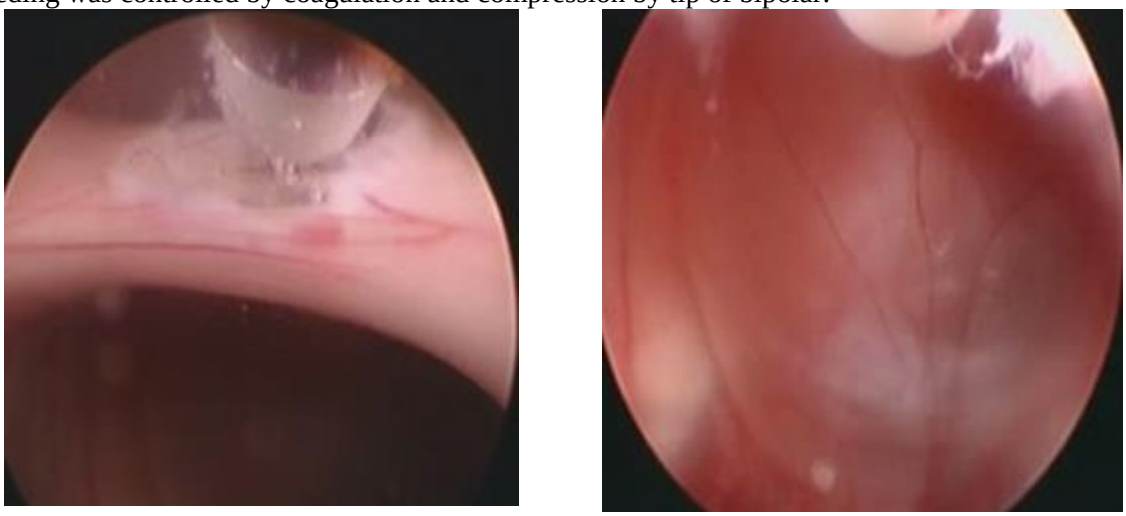


Figure (4): Intra-operative view in pineal tumor

After ETV we introduced endoscope though new burr hole 4 cm anterior to burr hole of ETV, identification of foramen of Monoro and entry to 3rd ventricle to posterior part and notified inter thalamic adhesion and dissected by bipolar. Then identification of tumor in his place, coagulation of the surface of cystic part and insertion to aspirate its content for analysis and take multiple sample by biopsy forceps for analysis until AS opened. Some minor bleeding was controlled by coagulation and compression by tip of bipolar.



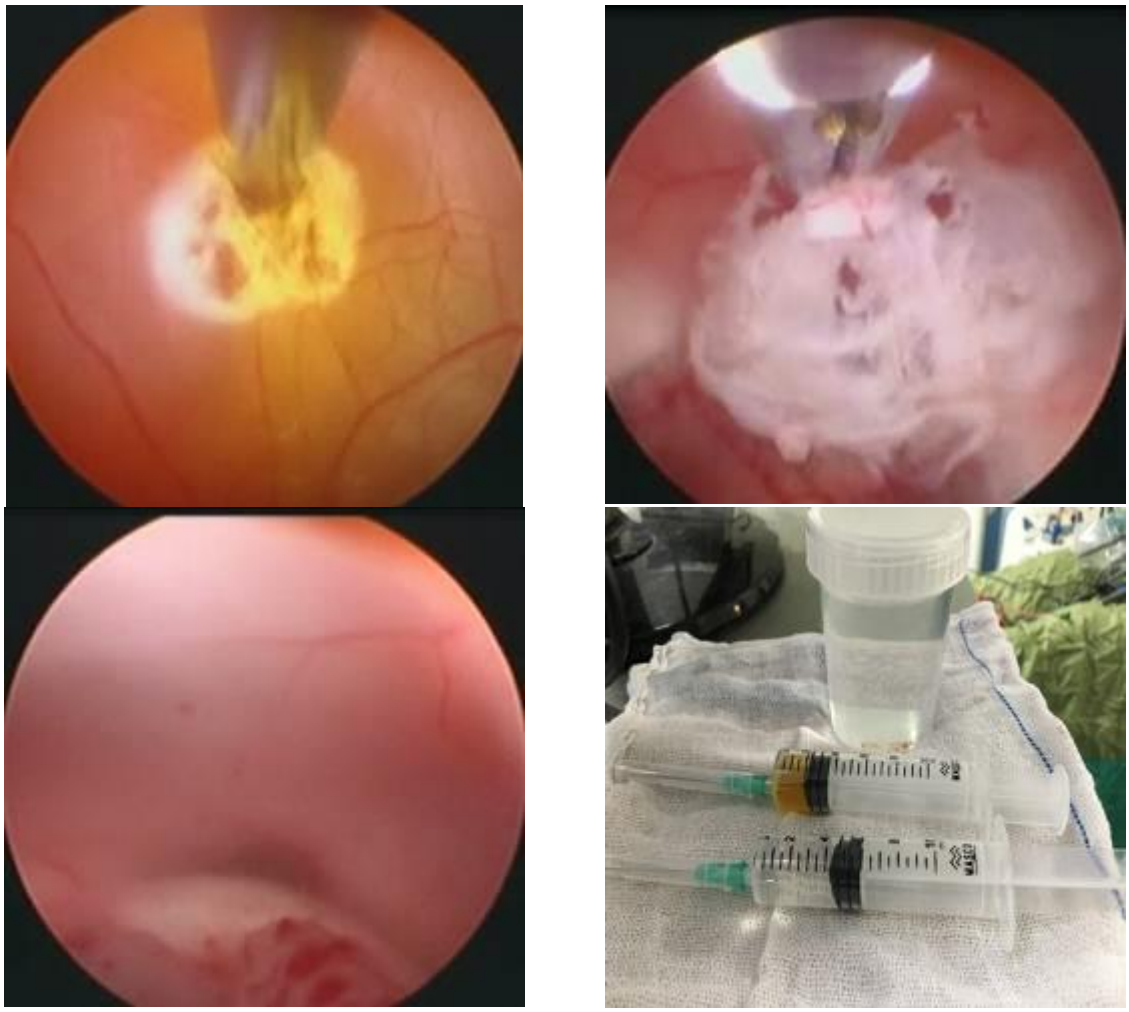


Figure (5): Operative technique and biopsy in pineal tumor

After surgery CT scan was done and hydrocephalus and case complaint were relieved.

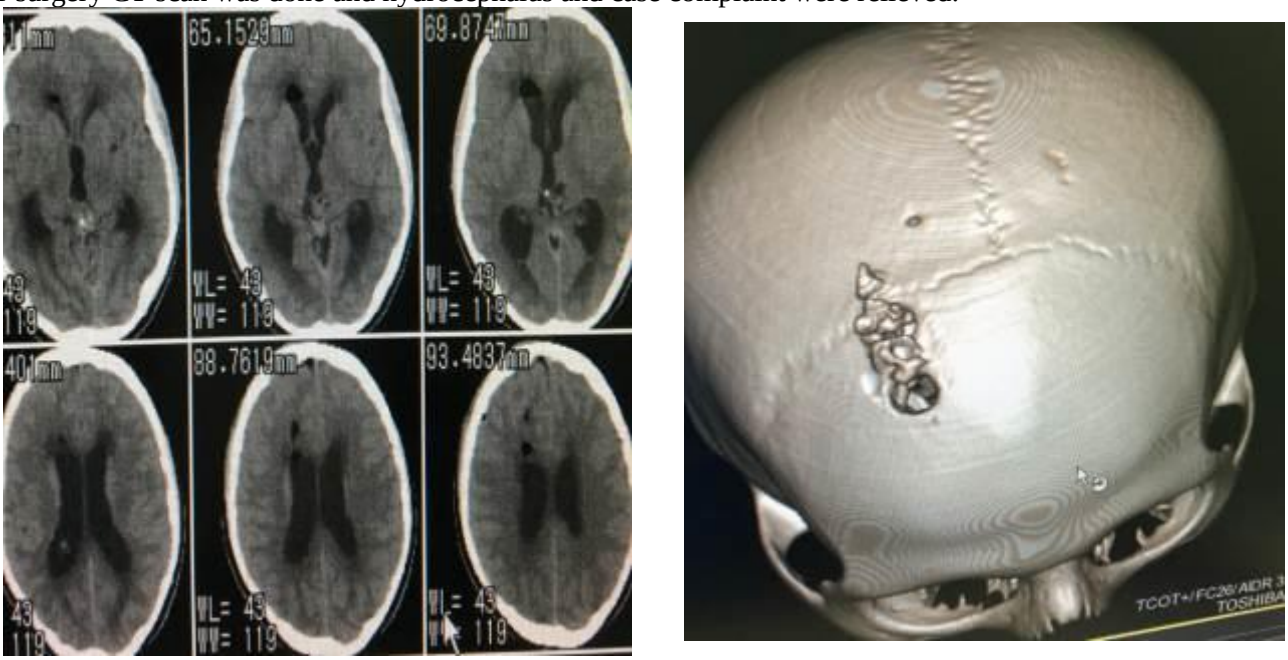


Figure (6): Post-operative CT in pineal tumor case

Sample result is germ cell tumor and CSF sample is free then case referral to oncologist for chemotherapy.

DISCUSSION

In our study, regarding age of patients, there was no statistically significant difference as regards age. This agrees with **Yurtseven** [8] who underwent 18 cases of IV tumors age from 2-68 years with median 12 years**.** This also agrees with another study who underwent 30 cases of IV tumors age from 4-65 years with mean 33.7 [3]. **Telfeian *et al*.** [9] disagree with our study as regard age of patients, which ranged from 20 to 76 years with a mean age of 40 years. This disagreement could be explained by the fact that their patients were Nineteen patients underwent endoscopic treatment for colloid cysts of the third ventricle only.

Concerning sex, **Gaab and Schroeder** [3] agree with our study, who underwent 30 cases of IV tumors 19 of them were males (63%) and 11 of them were females (37%)**.** Although we reported a predominance of males, others have nearly equal numbers as **Jeffree and Besser** [10] who underwent 39 cases there were 20 women**.** In addition, according to another study in which 18 patients were done, 15 of them were males (83%) and 3 (17%) were females. This disagreement could be explained by the fact that patients were only 18 patients underwent endoscopic treatment for IV tumors most of them were low grade astrocytoma [8]. Also, disagrees with **Hellwig and Bauer** [11] who underwent 9 patients, 5 of them were females and 4 were males. This disagreement could be explained by the fact that all of the 9 patients were colloid cysts.

The leading symptoms in patients in our study was headache, which represented 28 cases (93.3%), which is statistically significant. Besides, there were seven cases with vomiting, two cases with gait disturbance, three cases with syncopal attack, three cases with hemiparesis, two cases with seizures, two cases with CN palsy, one case with growth retardation, one case with low intelligence, four cases with visual disturbance and one case with disturbed conscious level. In **Yurtseven** [8] reported that there were symptoms and sign of increased ICP plus, seven cases of gait disturbance, four cases with seizure, facial palsy, aphasia, Diabetes insipidus, hemiparesis, tremors and urinary urgency.

Also according to **El Khoury *et al.*** [12] and **Sribnick *et al.*** [13]**,** the leading symptoms was headache which represented 79 % and 87.5 % respectively**.**

In our study, regarding association of hydrocephalus with tumor, there were 24 cases (80%) associated with hydrocephalus while 6 cases (20%) were not associated with hydrocephalus, which was statistically significant. This agrees with **Gaab and Schroeder** [3] who underwent 30 cases of IV tumors. 21 of them (70%) were associated with hydrocephalus and 9 of them (30%) were not associated with hydrocephalus**.** This disagrees with the study of **Hellwig and Bauer** [11] where all of their cases were associated with hydrocephalus. This disagreement could be explained by the fact that all of their studied cases were colloid cyst only**.**

In our study, regarding location of tumor, there were 19 cases (63.3%) in 3rd ventricle while 11 cases (36.7%) in lateral ventricle. **Yurtseven** [8] agrees with our study, where they underwent 18 cases of IV tumors, 12 of them (66.7%) were in 3rd ventricle and 6 of them (33.3%) were in lateral ventricle. **Shunji *et al.*** [14] disagrees with our study, as there were 66.7% of his cases in lateral ventricle and 33.3% in 3rd ventricle. This disagreement could be explained by the fact that their patients were only six patients and all of them were astrocytoma.

El Khoury Carl *et al.* [12] in his study noted that 89% of hyperdense cysts on CT had difficulty in aspiration, while 31% of hypodense cysts underwent easy aspiration. The more the cyst became hyperdense, the more its aspiration was difficult**.** In our study, ten cases were colloid cysts two of them hyperintense in T1 and hypointense in T2 which make surgery is difficult. One of them was recurrent after one and half year because of residual content and the other case was operated microscopically after six months due to thick content. And the other eight cases were hypointense in T1 and hyperintense in T2 with range size from 12 mm to 25 mm.

In our study, regarding pathological finding of the tumor, there were 10 cases (33.3%) colloid cyst which represent the most common lesion in the 3rd ventricle, 3 cases (10%) were low grade glioma, 3 cases (10%) were central neurocytoma, 2 cases (6.7%) were astrocytoma, 2 cases (6.7%) were choroid plexus papilloma, 2 cases (6.7%) were metastasis, 1 case (3.3%) was germ cell tumor, 2 cases (6.7%) were craniopharyngeoma, 1 case (3.3%) was teratoma, 1 case (3.3%) was meningioma, 1 case (3.3%) was ependymoma, 1 case (3.3%) was choroid plexus carcinoma and one patient's pathological report revealed no tumor. **Gaab and Schroeder** [3] agree with our study, where they revealed that seven cases were colloid cysts, five astrocytomas, three subependymomas, two ependymomas, and one each of the following: pineoblastoma, pineocytoma/pineoblastoma (intermediate type), epidermoid cyst, pineal cyst, medulloblastoma, craniopharyngioma, arteriovenous hemangioma, cavernoma, choroid plexus papilloma, pituitary adenoma, melanoma, and germinoma. In one specimen, no abnormal tissue was identified, but the lesion was presumed to be a low-grade astrocytoma. **Auer** [15] disagrees with our study, who revealed that the most common pathological findings of tumors

encountered in his series were cystic glioma (grade 2 or 3) and cystic metastases. This disagreement could be explained by the fact that their patients were twenty-four who had brain tumors (12 ventricular and 12 cystic cerebral or cerebellar tumors) and were operated on for biopsy, evacuation of cyst, resection and removal of the cyst**.**

In our study, regarding post-operative complications, there were 25 cases with no complications (83.3%), one patient complaining of post-operative mild memory impairment, one patient complaining of increased degree of hemiparesis, one patient complaining of C.S.F leakage and VP shunt was inserted, and 2 cases had bloody tumor intra-operative, not controlled, and died. So as regards the post-operative complications of endoscopy, there was statistically significant difference with low rate of associated complications. **Yurtseven** [(8)] agrees with us, where there were 18 cases of IV tumors. 15 of them (83%) were not associated with any complications and 3 of them (17%) were associated with complications in the form of CSF leakage and bleeding intra-operative.

Regarding post-operative outcome of the studied cases according to modified Rankin scale, there were 15 cases (50%) very good outcome, 10 cases (33.3%) were good outcome, 3 cases (10%) were poor outcome, and 2 cases (6.7%) died, which is statistically significant. **Gaab and Schroeder** [(3)] agree with our study, where there were 30 cases of IV tumors; 20 cases (66.7%) were very good outcome, 5 cases (16.7%) were good outcome, 3 cases (10%) were poor outcome, and 2 cases (6.7%) died [(3)]**. Margetis and Souweidane** [(16)] disagree with our study, where they collected 422 cases of colloid cyst, which had been resected endoscopically and found that there were 86 % of cases of very good outcome, 8.5 % of cases with good outcome, and 5.5% of cases with poor outcome. This disagreement could be explained by the fact that the large number of his studied cases and all of them were colloid cyst**.**

CONCLUSIONS

Regarding endoscopic treatment of intra ventricular tumors, there are many advantages of the endoscopic approach as low rate of complications, better outcome as minimal dissection and brain retraction, rapid access to the target and excellent visualization of the lesion and surrounding structures. Endoscopic approach also has the ability of treatment of the associated hydrocephalus at the same session with low rate of failure or recurrence. We consider endoscope is the method of choice for removal of colloid cysts and restore CSF pathway obstructed by tumors. However, it has some limited role in cases of intraventricular tumors because of total excision is risky so biopsy only done for these cases.

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