

## Decision Making in Management Of Lateral Ventricular Tumors

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**Abstract:** Lateral ventricular tumors are usually slowly growing and become symptomatic after attaining a large size. The common tumors are ependymoma, choroid plexus papilloma and carcinoma, giant all astrocytoma and meningioma. The common symptoms and signs of presentation are due to rise of intracranial pressure. Approaches are determined upon several factors including: the size of the ventricles, location and size of the tumors, and the site of origin. The management options include: direct microscopic resection of the tumor (Transcortical or transcallosal), preliminary shunt before tumor attack, preliminary ETV, direct endoscopic resection of the tumor, and Gamma knife radiosurgery. Preliminary shunt may lead to seedling of the tumor and may convert a roomy lateral ventricle to a slit ventricle rendering tumor approach a difficult situation. **Material and methods:** Twelve cases of lateral ventricle tumors with hydrocephalus are managed surgically; six of them undergone direct tumor resection either microscopic or endoscopic via the transcortical approach, five cases managed by initial shunt and one case managed by initial ETV before tumor resection. **Results:** Negative effects of preliminary shunt appeared in the form of seedling via the shunt tube with the development of malignant CSF ascites in two cases and collapse of the lateral ventricles before tumor resection in two cases and development of subdural hematoma in one case. The outcome was good in 58%, fair in 17% and poor in 25% of cases. **Conclusion:** Lateral ventricle tumors present a unique surgical challenge. They should be managed in their early stages by aggressive surgical excision and the shunting of CSF is to be considered a second stage of the management to minimize the chance of CSF seedling and to avoid the development of slit lateral ventricles before tumor resection.

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### 1. Introduction:

Lateral ventricle tumors account for approximately 1% of all intracranial tumors. They are usually slowly growing and become symptomatic after attaining a very large size. They produce symptoms caused by hydrocephalus or by exerting pressure on adjacent structures particularly if the foramen of Monro or the aqueduct is blocked.

The common tumors of surgical importance in the lateral ventricles are: Ependymoma, subependymoma, Giant cell Astrocytoma, Glioma, choroid plexus papilloma, choroid plexus carcinoma and meningioma (Helmut *et al.*, 2011).

The presentation may be late because of no localization and the tumor grows in a roomy space and so may attain a large size before presentation.

Symptoms of the increased ICP may be due to excess CSF secretion or obstruction of CSF pathways. Patients may present with drop attacks due to bouts of rise of CSF pressure. The radiological presentation is usually lateral ventricle mass with hydrocephalus.

It's important to evaluate the critical vessels of the lateral ventricles. The anterior choroidal artery; a branch of the internal carotid artery that enters the temporal horn via the anterior part of the choroidal fissure. The lateral branch of the posterior choroidal artery; a branch of the posterior cerebral artery that

enters the atrium through the posterior part of the choroidal fissure.

The internal cerebral vein runs in the roof of the third ventricle draining the septal, caudate and the thalamostriate veins (Piempmeier *et al.*, 1993).

The approaches to the lateral ventricle are determined by several factors:

- 1) Enlargement of the ventricles.
- 2) Location of the tumor in the ventricle.
- 3) Size of the tumor.
- 4) Site of attachment (origin).

The lateral ventricle is approached via transcallosal or trans-cortical approaches. The transcallosal approach can access both ventricles. It requires incision of the body of the corpus callosum that can access the frontal horn and the midportion or trigone but not the temporal and the bottom of the occipital horns. It doesn't require enlarged ventricles. The transcallosal approach should avoid significant bridging veins to the superior sagittal sinus.

The transcortical approach should mind eloquent areas and have the closest distance to the lesion and its attachment and this approach requires enlarged lateral ventricles. The advantages of the transcortical approach include that there is no handling of the fornix and the operative field is wider for tumor resection and for saving the ICP and its tributaries and the tumor can be

safely devascularized and internally debulked and dissected carefully of the adjacent structures (Greenfield *et al.*, 2012).

The management options include:

- 1) Direct microscopic surgery for tumor excision (Transcortical or Transcallosal).
- 2) Preliminary shunt (unilateral or bilateral) before tumor attack.
- 3) Preliminary ETV before tumor attack.
- 4) Direct endoscopic resection of the tumor.
- 5) Gamma knife radiosurgery.

What to do first; shunt or direct tumor attack?

Shunt may convert a roomy lateral ventricle to a slit ventricle rendering tumor approach a difficult situation. Also shunt may help seedling metastasis to the peritoneal cavity in (V-P shunt) or systemic dissemination in (V-J shunt) specially in cases of choroid plexus carcinoma where cases of malignant CSF ascites had been reported. In cases of compensatory contralateral hydrocephalus; shunt may lead to a shift of the midline with more clinical deterioration.

Bleeding is the main technical problem during direct surgical resection of the tumor which commonly obscures the field, so better to start with devascularization.

#### **Aim of the work:**

This study represents an overview of the problems that expected to be met with during the management of lateral ventricular tumors. It also displays the different options in surgical management and their negative effects with the author's experience in this context.

The aim is to achieve an optimal decision, effective management and total surgical resection.

## **2. Material and Methods:**

This is a retrospective study that had been done at Al-Azhar University hospitals in the period between 2010-2013. The study has included 12 cases of lateral ventricular tumors; 8 males and 4 females, ranging in age between 2 years and 55 years with median age 22.16. all the cases presented to the OPD of Al-azhar University hospitals with a spectrum of clinical presentations including symptoms of increased intracranial pressure, epileptic fits, focal neurologic deficits, large head, unsteady gait and depression of the level of consciousness.

All the cases had undergone full clinical assessment by history taking and clinical examination. MRI of the brain done for all cases and CT brain done for some cases in whom tumor calcification was expected from their MRI. Nine cases showed that the tumor is unilateral (limited to the confines of one lateral ventricle) and 3 cases showed that the tumor has extended to the contralateral ventricle via the septum pellucidum.

Hydrocephalus was found in 11 cases and only 1 case showed contralateral ventricular dilatation.

All the cases had undergone surgery.

For 6 cases direct approach for tumor resection without shunt had been done; 2 of which done endoscopically.

Five cases of hydrocephalus with bilateral ventricular dilatation; for them initial V-P shunt had been done and later they have undergone a late surgery for tumor resection.

One case of hydrocephalus with bilateral ventricular dilatation; for it initial ETV done and later another setting for tumor resection had been done.

Following tumor resection external ventricular drainage is kept for three to five days till the ventricles become clear of blood.

**Table (1): Shows the age incidence of different pathologic lesions and the number of cases.**

Pathology	No. of Cases	Percent	Ages in Years
1 ) Choroid plexus carcinoma.	3	25%	2, 3, 5
2 ) Choroid plexus papilloma.	3	25%	10, 18, 22
3 ) Ependymoma.	3	25%	6, 25, 35
4 ) Giant cell Astrocytoma.	2	17%	40, 45
5 ) Meningioma.	1	8%	55

**Table (2): Shows the different surgical procedures applied in the study.**

Surgical Procedure	Number of Cases	Percent
1 ) Initial shunt with late tumor resection.	5	42%
2 ) Direct microscopic tumor resection.	4	33%
3 ) Endoscopic tumor resection.	2	17%
4 ) Initial ETV and late tumor resection.	1	8%

Different varieties of histopathologic results had been found including choroid plexus carcinoma (3 cases), choroid plexus papilloma (3 cases), Ependymoma (3 cases), meningioma (1 case) and giant cell Astrocytoma (2 cases). The program of follow-up was 1 month, 3 months, 6 months and 1 year postoperative visits.

**Table (3): Shows the steps of management of each pathologic lesion and the number of cases.**

pathology	Number of cases	Initial shunt and late tumor resection	Direct microscopic tumor resection	Direct endoscopic tumor resection
1) Choroid plexus carcinoma.	3	2	1	-----
2) Choroid plexus papilloma.	3	2	-----	1
3) Ependymoma.	3	-----	2	1
4) Astrocytoma.	2	1	1	-----
5) Meningioma.	1	1 (ETV)	-----	-----

**3. Results:**

The incidence of lateral ventricular tumors in this study is found more in males with a male to female incidence 2:1.

Regarding the age groups; choroid plexus carcinoma is found in young children group with ages 2, 3 and 5 years old, while meningioma is found in the middle age 55 years. Choroid plexus papilloma found in ages 10, 18 and 22 years old.

Headache of intracranial hypertension was found as a main symptom in 75% (9 cases). The presentation of all cases was late after the tumor has attained a large size.

Choroid plexus carcinoma found in young children and this added more to the delay of the diagnosis as they presented with large head, unsteady gait and failure to thrive in 3 cases 25%.

Drop attacks due to bouts of rise of intracranial pressure found in four cases 33% and virtual epileptic fits found in one case 8%.

Hydrocephalus with bilateral ventricular dilatation found in 11 cases, 6 of them 50% managed by direct tumor attack without a prior shunt and 5 of them managed by initial shunt and later they have undergone another surgical setting for tumor resection. One case, the hydrocephalus of which managed by initial ETV and later another setting for tumor resection.

Hydrocephalus was most marked in cases of choroid plexus carcinoma and papilloma 50% pertaining to the over CSF secretion exceeding the rate of drainage.

Initial shunt has greatly improved the patient's clinical condition and showed radiological improvement of the ventricular dilatation as seen in the follow-up brain CT. On the other side; shunt

complications developed in 2 cases due to peritoneal seedling of the tumor cells across the shunt tube and the development of malignant CSF ascites.

For one case of Giant cell astrocytoma with contralateral huge ventricle dilatation; shunt has led to more clinical deterioration probably due to breaching of the pressure gradient that had led to shift and transverse herniation.

Two cases in which shunt has led to collapse of the lateral ventricles that had made the second setting for tumor resection difficult. One case of choroid plexus papilloma developed subdural hematoma after tumor resection that necessitated repeated tapping.

Six patient 50% in the present study had been operated upon directly for tumor resection without a prior shunt; four of them 33% managed by microscopic tumor resection and two of them 17% managed by endoscopic resection.

The results of direct tumor resection without shunt was encouraging in view of the wide lateral ventricles and the easiness of dissection of the tumor all the way round and avoidance of shunt complications.

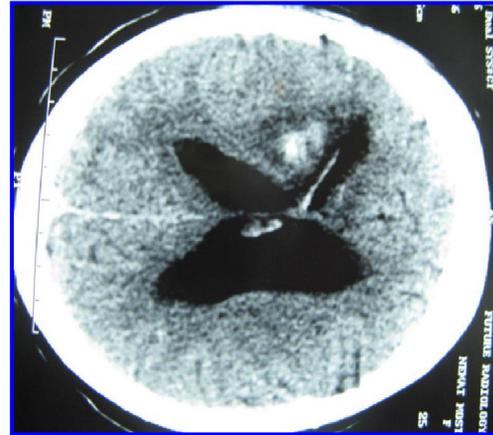
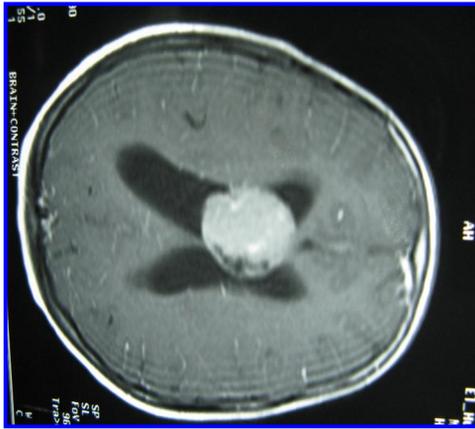
Cases which had been operated upon in a second setting for tumor resection after a shunt showed difficulty in microscopic tumor dissection because of the collapsed ventricles and some of which developed shunt complications.

The decision of initial shunt or direct tumor resection had depended upon the patient's condition regarding the degree of rise of intracranial pressure where patients with severe intracranial hypertension were chosen for initial shunt. The considered clinical signs for the endocranial hypertension were mental confusion and neck stiffness.

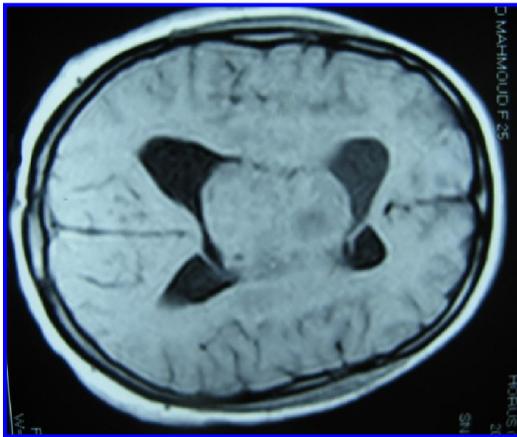
**Table (4): Shows the negative effects of initial shunt.**

Negative effects of shunt	Number of cases
• Seedling and CSF ascites.	2
• Breaching of the pressure gradient and transverse herniation.	1
• Collapse of lateral ventricles with difficult second setting.	2





**Images (6), (7): Choroid plexus papilloma Excised directly by the endoscope.**



**Images (8), (9): Ependymoma managed directly by endoscopic excision.**

Complete tumor resection had been achieved in 9 cases 75% and subtotal resection was performed in 3 cases 25% two of them with choroid plexus carcinoma after shunting and one case of astrocytoma.

The case of choroid plexus carcinoma which survived after surgery died after one year with multiple brain and spine metastasis.

Cases of choroid plexus papilloma passed well after surgery and represented excellent clinical condition on follow-up. Cases of Ependymoma as well as meningioma did well in frequent follow-up clinical and radiological assessment.

**Table (5): Shows the morbidity and mortality in relation to the different surgical procedures.**

Surgical procedure	Morbidity	Number	Mortality number
1) Initial shunt and late tumor resection.	1- CSF ascites. 2- Mental confusion due to breaching of pressure gradient and transverse herniation. 3- Left sided dense hemiparesis.	2 1 1	3
2) Direct microscopic tumor resection.	1- Left hemiparesis. 2- Subdural hematoma.	1 1	
3) Endoscopic tumor resection.	-----	-----	-----

4) ETV and late tumor resection.	-----	-----	-----
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**Table (6): Shows the morbidity and mortality in relation to the pathology.**

Pathology	No. of cases	Morbidity	No. of cases	Mortality Number of cases
1) Choroid plexus carcinoma.	3	CSF ascites	2	2
2) Choroid plexus papilloma.	3	Subdural hematoma	1	-----
2) Ependymoma.	3	-----	-----	-----
4) Astrocytoma.	2	Transverse herniation.	1	1
		Left hemiparesis	2	-----
5) Meningioma.	1	-----	-----	-----

Cases of subependymal giant cell Astrocytoma, one of which didn't survive more than two weeks postoperatively, and the other case received radiotherapy and died after one year with recurrence.

The outcome is considered Good in 7 patients 58% where there are no neurologic deficits and complete tumor resection achieved, fair in 2 patients 17% where the tumor had been excised totally with permanent neurologic deficits, and Poor in 3 patients 25% where incomplete tumor resection done and the patient developed severe complications and didn't survive.

At one year follow-up recurrence was found in 2 cases 16.6% one with Choroid plexus carcinoma with multiple metastasis and one with subependymal giant cell astrocytoma.

Gamma knife radiosurgery was not utilized in the management of the cases of the present series.

**4. Discussion:**

The present study revised 12 cases of lateral ventricle tumors, the management of which depended upon the presenting clinical condition and the radiologic appearance regarding the tumor criteria and the presence of hydrocephalus.

To improve the symptoms caused by a ventricular tumor and to prevent further deterioration, total removal of the ventricular lesion is usually attempted and may be performed as a first line therapy. However, in some cases it is advisable to first reestablish CSF circulation in the case of obstruction, either by ETV if possible, or by insertion of a permanent V-P shunt.

This initial procedure is followed by microsurgical resection of the underlying ventricular lesion.

Piepmeyer *et al.*, 1993, in their study recorded that approximately 10-50% of patients will ultimately require CSF diversion. In the present series 5 cases 42% of the patients had been operated initially by shunt because of the severe intracranial hypertension.

Secer *et al.*, 2008, realized that the number of patient requiring a shunt varies based on different factors which may be in our opinion clinical, radiological, pathological and technical regarding the plan of the surgical approach.

In a series conducted by Lena *et al.* (1990), 78% of all the children included in their study with intraventricular choroid plexus tumors underwent permanent shunt placement and the same surgeons advocate for preoperative placement of a permanent shunt in patients with tumors of the lateral ventricles and hydrocephalus. In contrast, Amar *et al.*, 2004, prefer to place a ventriculostomy at the time of surgery whenever hydrocephalus in present considering that a significant number of patients will recover the CSF circulation after the removal of the tumor and this reduces the need for a permanent shunt dramatically.

Lawton *et al.* (1996) used ETV preoperatively and reserved the shunts for the patients who continued to have impaired CSF circulation after surgery.

In their series V-P shunts were required in only 12.5% of the patients. Reiger *et al.* (2000) reported that the associated hydrocephalus requires a CSF diversion in more than 90% of the patients.

The associated shunt-related complications and the occurrence of shunt dependency have been a constant problem with these patients.

It's presumed that the increased protein content in the CSF and the cellular debris result in a higher incidence of shunt malfunction.

The present study in spite of carrying the disadvantage of the too limited number of cases; it makes a trial to select the best option in the management of cases of lateral ventricular tumors based on the expected pathology from the radiologic study, age of the patient, clinical and neurologic condition and the degree of hydrocephalus.

Once the surgeon is confronted with a case of lateral ventricle tumor, the following options regarding the management arise:

- To start with shunt (V-P or V-A).

- To do ETV.
- To do direct microscopic resection of the tumor.
- To choose the transcortical or transcallosal approach.
- To do direct endoscopic resection.
- To have a biopsy (endoscopic or stereotactic).
- To utilize Gamma knife radiosurgery.

The present study depended upon the neurologic condition of the patient regarding the severity of symptoms and signs of intracranial hypertension specially the level of consciousness and neck stiffness upon which a preliminary shunt was decided to alleviate the rise of intracranial pressure.

Although most surgical interventions for ventricular tumors are elective surgical procedures, emergency surgery may be required in patients with acutely developed obstructive hydrocephalus or when acute intratumoral hemorrhage has occurred. Helmut *et al.* (2011), in their study recorded required emergency surgery in approximately 11% of their own patients.

In the present study 50% of cases had been managed by an initial procedure (shunt or ETV) on an urgent basis to alleviate the intracranial pressure. The high percentage of urgent CSF diversion in the present study can be attributed to the nature of the pathology; choroids plexus papilloma and carcinoma where CSF resection is exceeding the rate of drainage resulting in sever endocranial hypertension.

There was marked initial improvement in the neurologic condition after CSF diversion in those patients with sever manifestations of hydrocephalus. Later, the negative effects of the shunt appeared in the form of seedling of the tumor and collapse of the lateral ventricles.

Seedling of the tumor via the shunt tube to the peritoneal cavity and implantation of the tumor seeds on the pritone with the development of CSF malignant ascites happened in two cases in the present series the pathology of which was choroid plexus carcinoma.

The problem of the risk of seedling metastasis through shunting was brought up by Burger *et al* 1991, when they reviewed the outcome of 415 children with CNS tumors. Shunts were inserted in 152 children. Extranural metastasis occurred in 5 patients without any shunts, while 2 occurred with a shunt in place with virtually identical incidence.

Suresh *et al.* (2004) estimated the incidence of CSF seedling in Germinoma to range from 7-12% but higher figure up to 57% have also been reported in the literature Leibel (1987).

The tumor cells that enter the CSF, flow freely throughout the subarachnoid space, often lodging a significant distance away from their entry point. Once the tumor cells have gained access to the subarachnoid

space, they spread to other portions of the meningeal surface by direct extension or by shedding cells that are then carried to different parts of the neuraxis by CSF flow.

Russeland (1971) and Rubinstien (1972), concluded that shunts do not appreciably favor the occurrence of metastasis and malignant spread, and metastasis through shunts are said not to occur.

Brownell and Oppenheimer (1976) assumed that it is obvious that in cases of tumor cell passage a ventriculo-peritoneal shunt will lead to intraperitoneal seedling and result either in solid tumor or malignant ascites or both. And they realized that although the risk of distant spread is real, it is indeed very low. Because of the frequent failure of shunts and the need for them to be revised beside the potential risk of seedling, pre-resection ETV is performed in few centers Muzumdar *et al.* (2010).

The same concept of seedling via shunt tube had been emphasized by Goel *et al.* (1993), Goel, (2000), and Muzumdar *et al.*, (2004), when they realized that the tangible risk of hemorrhage in the tumor and seedling or metastasis has lowered the incidence of preoperative CSF diversion. Although, Millipore filter have been advocated for prevention of seedling, a higher risk of shunt malfunction is still a common problem.

The collapse of the lateral ventricles following shunt insertion has happened in two cases in the present series and resulted in loss of the roomy ventricles with marked difficulty in the second setting for tumor resection; that is called the post shunted slit-like ventricles.

Epstein *et al.* (1998), and Walker *et al.* (1993), stated that while the incidence of asymptomatic slit ventricles is relatively common, several studies have shown that the symptomatic slit ventricle syndrome occurs infrequently in approximately 6-12% of shunted children.

Two cases in the present study had been managed by direct endoscopic resection.

Jeffrey *et al.* (2012) approved endoscopic surgery for intraventricular tumors because of the central and deep location and the conventional neurosurgical approaches have a relative increase in potential morbidity.

Auspiciously, the location of intraventricular tumors being within a CSF compartment affords excellent light and image transmission. The fact that most intraventricular tumors cause hydrocephalus makes endoscopic surgery particularly attractive since simultaneous procedures can be employed both for CSF diversion and tumor management. In addition, the inherent benefits of minimally invasive techniques including reduced surgical time, improved cosmetic results, shortened hospital stay, and reduced cost also

factor into the appeal of neurosurgical endoscopy for managing such tumors.

There has been considerable debate regarding prioritization of the procedures during ETV and tumor biopsy.

Oka *et al.* (1999), advocate tumor biopsy before third ventriculostomy to minimize the potential dissemination of tumor cells into the basal cisterns during irrigation after biopsy and also to prevent the collapse of the ventricle while taking biopsy.

The transcallosal approach hasn't been utilized in the present series; only the transcortical approach is the one applied as it makes it possible to excise lesions in all the regions of the lateral ventricle via an appropriate microsurgical working space with flexibility of the maneuvers within the lateral ventricle. The key to a successful transcortical approach is an understanding of the functional anatomy of eloquent cortex, the location of the lesion, and its vascular supply.

The nature of the author's practice and experience dictated to use the transcortical approach rather than the transcallosal one.

Nagasawa *et al.* (1997) approved the transcortical approach and found it simple and attractive alternative to the transcallosal approach. The results in Nagasawa *et al.* (1997), was 86% good outcome, 14% fair and no poor outcome.

The results in the present series is good in 58%, fair in 17% and poor in 25%. The marked difference in good and poor outcomes is explained by the marked difference in the patient number and the pathologic nature of the lesions.

The transcortical approach in the present series was planned for each case specifically according to the location of the tumor in the lateral ventricle, the expansion and size of the tumor, the origin of the vascular feeding and the relation to the choroid plexus and the internal cerebral vein. Timurkaynak *et al.* (1986), and Radoi *et al.* (2014), are going in the same way and stated that the ideal surgical approach is the shortest distance to the lesion with a perpendicular field of view that requires minimal retraction of the brain, avoids trajectory through important structures, and provides clear visualization of the vascular feeding branches.

The anterior transcortical approach is facilitated when the lateral ventricles are enlarged. Sometimes the tumors change the location of the lateral ventricle. In these cases, it is important to locate the foramen of Monro to avoid damage of the fornix; Halil Brahim *et al.* (2008).

The transcortical frontal approach was commonly used in this study beside the other transcortical approaches; parietal and temporal with great caution using all the fine techniques when operating on the left hemisphere.

Batjer and Samson (1987), Gokalp *et al.*, (1998), and Ellenbogen (2001); in their studies realized that the superior parietal route is one of the best approaches for reaching the posterior part of the body, atrium, and the glomus of the choroid plexus. Postoperative cortical damage manifested by a visual field cut can occur if the medial wall of the atrium adjacent to the calcarine cortex is injured. So, the cortical incision should be made high enough to avoid the optic radiation. As the vascular supply to the tumor is deep, the transcortical superior parietal approach does not provide an optimal access to vascular control before tumor removal. The approach can be applied safely in the dominant hemisphere when performed using minimal retraction for a relatively small tumors located in the occipital horn and atrium.

Richard *et al.* (2003), favored the use of the interhemispheric transcallosal approach and considered that approach have become more popular; in that no cortical brain tissue has to be violated to provide direct access to the ventricular system.

In the last series, the authors have recorded mortality rates far lower than 10% considering the death in the microsurgical era is usually secondary to catastrophic postoperative hemorrhage or pulmonary embolism; Gokalp *et al.* (1998), Jeaves *et al.* (1979), and Piempier *et al.* (1993).

In the present series 3 cases died (25%) in the early postoperative period; two of them with choroid plexus carcinoma developed malignant CSF ascites with seedling and severe electrolyte disbalance and one case with astrocytoma developed severe brain oedema and shift of the midline with transverse herniation.

Regarding the surgical approach for trigone meningioma, Takafumi (2012), realized that the basic approach is occipital interhemispheric transcortical one. A small or medium-sized tumor with a major blood supply from the posterior choroidal artery can be totally removed by this approach, even in patients with a tumor in the dominant hemisphere. A small or medium-sized trigone tumor supplied mainly by the anterior choroidal artery can also be removed via this single approach although some blood loss can occur. Also he insisted for very large and vascular tumors fed equally by both the anterior and posterior choroidal arteries; the occipital interhemispheric transcortical approach can be considered. For large vascular tumors in the non-dominant hemisphere fed mainly by the anterior choroidal arteries, an anterior temporal horn approach via an inferior temporo-occipital incision can be considered.

Takafumi (2012), also recommended awake surgery by mapping cortical speech areas before reaching the tumor in the dominant hemisphere.

The results of Brahim *et al.* (2008), are comparable with the present study in their finding of

the rise of intracranial pressure being the commonly presenting manifestations 52% in their study and 75% in the present series. Total tumor resection is achieved in 9 cases 75% and subtotal resection is performed in 3 cases 25% in the present study.

In the study done by Brahim *et al.* (2008), they have achieved total tumor resection in 60% in the group of their cases.

Fornari *et al.* (1981) and Piepmeier *et al.*, (1993), measured the reported risk of postoperative seizures after transcortical approach to be 19% to 75%.

Fortunately, the present study didn't report cases of postoperative seizures probably due to the limited number of cases of the present series and also there are many factors that contribute to the development of seizures including the histological nature of the tumor, presence of preoperative seizures, refinement of the surgical technique, residual tumor, subdural hematoma, and electrolyte disbalance.

D'Angelo *et al.* (2005), in their study of 72 cases have attained total tumor resection in 82% of cases and this comes in the same way as the present series. They didn't record surgical mortality and the postoperative epilepsy rate was 5.9%.

In the present series, postoperative mortality is 25% (3 cases) with malignant tumors, seedling and malignant ascites with electrolyte disbalance in 2 cases and infiltrative astrocytoma in 1 case.

The policy in our work for cortical approaches is to go on double antiepileptics in the perioperative period and to shift gradually to monotherapy after three months that is why we didn't report postoperative epileptic fits. Lawton *et al.* (1996), reported no postoperative seizures among their 32 patients.

Mugurel *et al.* (2014), achieved total tumor resection in 73% of their cases of lateral ventricle tumors and this coincides with the result of the present study.

Mugural *et al.* (2014) reported the incidence of postoperative fits in 19.23% of cases of lateral ventricular tumors operated upon by transcortical approach. Also they reported a mortality rate of 3.8% (one out of 26 patients).

In a study done by Daniala (2013), they reported favorable outcome in 81% of their 202 cases and death rate 1.5%. also they recorded 7.5% hemiparesis, 3% aphasia, and 5% disconnection syndrome in (transcallosal approach). Their study also recorded 12% tumor recurrence at one year follow-up. This rate of recurrence approaches what had been found in the present study 16.6% and it mainly depends upon the histopathologic nature of the tumor.

Pendl *et al.* (1992) had a surgical mortality ratio of 5%; two of their patients died because of intracerebral hemorrhage while the other because of cerebral oedema. Nishio *et al.* (1990), didn't register

any postoperative deaths, but 10% of their patients were left with virtual neurological deficits. In the 11 children with choroid plexus tumors of the lateral ventricles, Lena *et al.* (1990), didn't register any postoperative deaths. Among the 32 patients operated by Lawton *et al.* (1996), there were no registered postoperative deaths, but 2 of them had transient neurological deficits.

## 5. Conclusion:

Tumors of lateral ventricles are rare, deeply seated lesions, relatively slow growing and can attain a large size before causing symptoms and medical attention. Because of their large size the treatment is surgical resection and the surgeon should prefer the shortest, most familiar and the most safe way in their resection.

There is a variety of tumors that arise within the lateral ventricles and they present a unique surgical challenge and their optimal surgical management remains controversial.

Effective management not only requires successful surgical therapy, but also returning the patient to normal neurological and cognitive function. Recognition of these problems and minimizing further injury are the best methods of providing for optimal outcome.

Lateral ventricular tumors should be managed in their early stages by aggressive surgical excision; and the shunting of CSF is to be considered a second stage of management to minimize the chance of CSF seedling via the shunt tube and to avoid the development of slit lateral ventricles before tumor resection.

Complete resection of many lateral ventricular tumors is possible and subtotal resection is preferred when the tumor is malignant and attached to eloquent structures.

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