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Surgical outcome of intraventricular tumors of the brain

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ABSTRACT

Background: Intraventricular tumors (IVTs) are rare brain tumors presenting with varied clinical symptoms depending on their specific anatomical location and their different Histopathology.
Case presentation: A retrospective analysis of 5 patients with IVTs presented in our institution from the period of 2 years from March 2020 to July 2022. The variables evaluated included the anatomical location, clinical symptoms, surgical approaches, postoperative complications and outcome of the patients. 2 cases of central neurocytoma, 2 cases of colloid cyst and 1 case of intraventricular epidermoid.
Conclusion: Surgical approaches to IVTs should be tailored based on the anatomical location of the tumor, its dimension, tumor extension and in addition the experience of the surgeon with such approach and their preferences. Trans-cortical approach is still a safe surgical corridor for IVT resection, which gives good clinical outcomes.

1. Background

In 1854 Shaw's has reported one of the earliest cases on intraventricular tumors (IVTs) in the history of neurosurgery. Tumors of the ventricles are very rare and constitute about 0.7 to 3% of all brain tumors and have a high incidence in paediatric and early adult population.[1] Lateral ventricles and third ventricle lies in contact with the critical neural structures: the caudate nucleus, the thalamus, the fornix, the corpus callosum, and the genu of internal capsule.[2] Tumors of the ventricles include colloid cysts, choroid plexus papillomas, ependymomas, subependymomas, epidermoid cyst and central neurocytomas.[3]

The first reported neurocytoma was described in 1982 by Hassoun et al. Neurocytomas account for only 0.25% to 0.5% of all brain tumors, and they are classified as central neurocytomas because mostly it originate intraventricularly from the septum pellucidum or the wall of the lateral ventricles.[4] Colloid cysts are histologically benign in nature, their midline location can cause obstruction of the foramen of Monro resulting in obstructive hydrocephalus. Even smaller lesions have been reported to be associated with sudden death.[5] Epidermoid cyst of the lateral ventricles are relatively rare. Probably the first such recorded intracranial lesion was seen in the lateral ventricle in 1745, when Verratus described an intra- ventricular mass containing hair.[6] There was no clear distinction between dermoid and epidermoid on those days. The surgical management of intraventricular tumors (IVTs) remains a distinct challenge for neurosurgeons due to their deep and difficult to reach location and frequent involvement of adjacent critical neurovascular structures.[7]

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2. Case Presentation

2.1. Case 1

A 29-year-old male presented to our OPD with a history of headache for 10 days associated with vomiting and a memory deficit. Patient was clinically stable with no neurological deficit. CT brain showed an irregular lesion in the lateral ventricle. MRI brain was done and showed measuring 7.1x4.5x5.6 cm lesion suggestive of central neurocytoma (Figure 1a). Patient underwent left frontal craniotomy, through transcortical approach total excision of the lesion was done and EVD was kept (Figure 1b). The patient developed transient right sided hemiparesis with aphasia. Patient improved significantly and was ambulant and fluent in speaking by post operative day (POD) 12. HPE was central neurocytoma. He was discharged on POD 14. 6 months follow-up was uneventful.

2.2. Case 2

A 36-year-old male presented to our OPD with a history of headache for 2 weeks and vomiting for 4 episodes in 1 day. CT and MRI brain was done which showed interventricular lesion of size 6.2x5.5x4.3cm with features suggestive of central neurocytoma. The patient underwent right frontal craniotomy, through a transcortical approach, excision of the lesion was done and EVD was kept. Post operative period was uneventful. Patient recovered well and discharged on POD 8.

2.3. Case 3

28 years old male was presented to our Emergency department with GCS - 4/15. CT brain showed a cystic lesion measuring 2.4x1.7x2.5 cm is seen at the level of 3^{rd} ventricle with obstructive hydrocephalus (Figure 2a). Patient was taken up for VP shunt as an emergency procedure. Patient improved neurologically to GCS -15/15. MRI brain was done which showed a large colloid cyst of 3^{rd} ventricle and patient underwent right frontal craniotomy and excision of colloid cyst (Figure 2b). Post operative period was uneventful and patient was discharged on POD 10.

2.4. Case 4

32 years old male, presented to our OP with a history of headache for 1 month and had RTA (Road Traffic Accident) 2 days back. CT brain showed a cystic lesion 1.8x1.2x1.4 cm at the level of foramen of Monro with dilated lateral ventricles. The patient underwent right frontal craniotomy and excision of colloid cyst. Post operative period was uneventful and patient was discharged on POD 6. Follow-up was uneventful.

2.5. Case 5

28 years old female, presented to our OP with a history of headache for 1 month and one episode of seizure 2 days back. Patient was clinically stable with no neurological deficit.

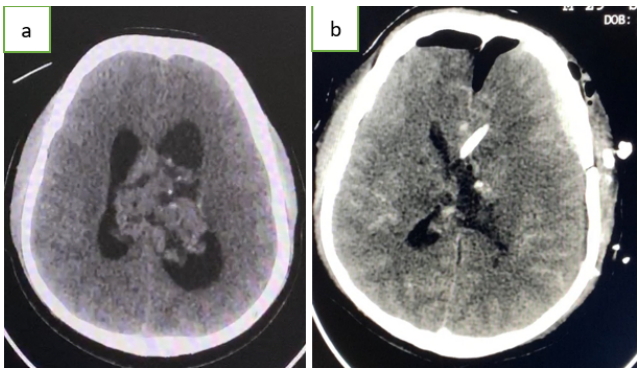

Fig. 1: a: CT brain was showed ill-defined lesion in the lateral ventricles; **b:** Transcortical approach total excision of the lesion was done with EVD insitu.

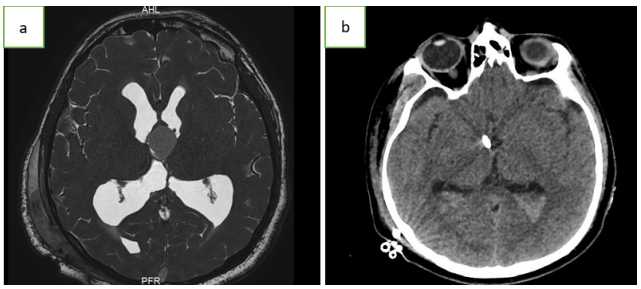

Fig. 2: a: MRI brain showed a cystic lesion measuring 2.4x1.7x2.5 cm is seen at the level of 3^{rd} ventricle with obstructive hydrocephalus; **b:** Right frontal craniotomy and excision of colloid cyst.

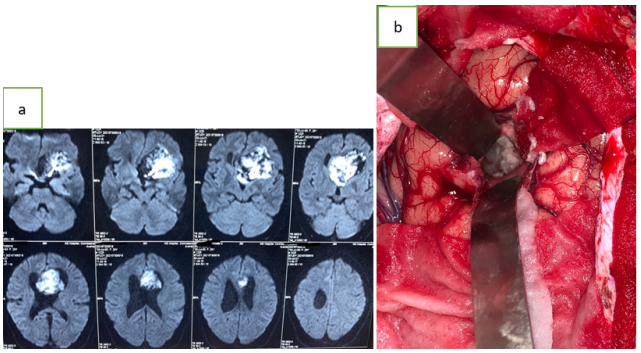

Fig. 3: a: MRI Brain showed a well-defined lesion in the frontal horn of left lateral ventricle with mass effect measuring 3.3x2.0 cm; **b:** left frontal craniotomy, through transcortical approach and total excision of the lesion was done

MRI Brain showed a well-defined lesion in the frontal horn of left lateral ventricle with mass effect measuring 3.3x2.0 cm (Figure 3a). The patient underwent left frontal craniotomy, through transcortical approach, total excision of the lesion was done (Figure 3b). Intra operative and post operative period was uneventful. Histopathology (HPE) was reported as epidermoid tumor. Patient improved without any neurological deficit and discharged on POD 7. After 6 months follow-up, the patient is seizure-free without antiepileptics (AED).

3. Discussion

3.1. Central neurocytomas

Initially, it was thought that all central neurocytomas were benign, mitotically inactive tumors that when totally excised resulted in cure. Although the majority of central neurocytomas seem to behave in this fashion, there are several cases reported in which they have recurred after gross total resection (GTR). Interestingly, in some of those patients to whom the tumor recurred, the initial resected central neurocytoma was devoid of malignant features such as necrosis, mitosis and the presence of neuroblastic cells.[4]

3.2. Epidermoid cyst

Epidermoids grow by accumulation of keratin and cholesterol, which are the breakdown products created by desquamation of epithelial cells. They grow linearly rather than exponentially at the same rate as the human skin. Such a linear rate of growth would be expected of tumours derived from a single layer of basal germinal cells spread over a surface area. The soft and pliable nature of the cyst wall and its contents explain the frequently observed growth patterns: as the cyst grows slowly, it simply "flows" into any available space. The expanding tumour conforms to the cavity it enters, and over a period of time, it tends to engulf structures such as cranial nerves and vessels. Their plasticity allows progressive, slow moulding of surrounding neural structures, and also allows for maintenance of a percolating type of CSF pathway. They may also expand and become enormous by neoplastic cellular growth, in some cases there has been transformation of histologically verified benign lesions to malignant ones.[6]

3.3. Colloid cyst

Characteristically colloid cyst appear as well- delineated hyperdense lesion at the foramen of Monro Usually the colloid cyst does not enhance on CT as well as on MRI . Larger lesions can be associated with calcification in the cyst wall. Most of the colloid cysts are hyperintense on T1- weighted MR images and on T2-weighted images becomes hyperintense in relation to brain parenchyma . Although on T2-weighted MR images, the appearance can range from hypointense to hyperintense, and the cyst can be homogeneous or heterogeneous.[8–10] Although on neuroimaging a diagnosis of colloid can be suspected, however histopathology will con

3.4. Surgical approach

Multiple surgical approaches have been described for each location in the LV system. The aim of each of these approaches is to provide an adequate corridor to the tumor while preserving eloquent overlying neurovascular structures. A careful review of the patho-anatomy from multiple planes on imaging studies, including MRI, MR.[7]

The surgical approach is variable, depending on the tumor location, size, and surgeon preference. Trans-callosal, transcortical, transventricular, and combined approaches have all been used with success. Because of the fact that most CNC arises in the septum, the fornices and thalami are pushed inferiorly by large tumors. The key to determine a safe plan for resection is identification of the ependymal surface of the floor of the ventricle anterior and posterior to the tumor. The choroid plexus and ependymal veins can then be used as guides for dissection along the inferior aspect of the tumor.[11]

For colloid cysts, opening of the septum pellucidum (approximately 10 mm) allows for bilateral entry using both foramen of Monro. The strategy for colloid cyst removal is cyst wall opening, removal of the contents, dissection of the cyst wall from the choroid plexus with bipolar coagulation under low setting, and dissection of the cyst wall from the delicate wall of the third ventricle. Simple cyst aspiration alone is not an adequate treatment for this condition.[3]

Surgical tenets are the same as for epidermoid surgery elsewhere, i.e., decompression of the puttylike contents, excision of lining membrane, preservation of choroidal vessels and ependyma, prevention of subependymal injury and prevention of contamination of the intra- ventricular cavity from the spillage of cyst contents: spillage can lead to chemical ventriculitis and hydrocephalus.[12]

4. Conclusion

Surgical approaches to IVTs should be tailored based on the anatomical location of the tumor, its dimension, tumor extension and in addition the experience of the surgeon with such approach and their preferences. Trans-cortical approach is still a safe surgical corridor for IVT resection, which gives good clinical outcomes.

5. Source of Funding

None.

6. Conflict of Interest

None.

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