Outcome of Open Transcortical Approach in the Management of Intraventricular Lesions

Saeed Mazher, Muhammad Imran, Junaid Ashraf, Atiq Ahmed, Irfan Ullah Shah and Farrukh Zulfiqar

ABSTRACT

Objective: To evaluate the outcome of management of intraventricular lesions operated by an open transcortical (non-endoscopic) approach.

Study Design: Case series.

Place and Duration of Study: Department of Neurosurgery, Dow University of Health Sciences and Civil Hospital, Karachi, from January 2009 to December 2011, with six months follow-up.

Methodology: All cases with lesions in the lateral ventricle and anterior third ventricle operated by open transcortical approach, were included after informed consent. Total excision of the lesion was attempted in all cases. Patients were analyzed for outcome in terms of establishment of diagnosis, completeness of resection, morbidity and mortality.

Results: A total of 33 patients were operated. Twenty three were males and 10 were females. Colloid cyst was diagnosed in 14 patients (42%), giant cell astrocytoma and choroid plexus papilloma in 4 cases each and subependymoma and central neurocytoma in 2 cases each, ependymoma, choroid plexus carcinoma, oligodendroglioma, metastasis, meningioma, ependymoma and cavernous haemangioma in one patient each. The overall outcome could be labeled as good in 24 out of 33 cases (73%) and in 8 cases (24%) it was fair. One patient died due to ventriculitis and was categorized as poor outcome (3%). Postoperative complications included meningitis, seizures, intraventricular haemorrhage, subdural collection and transient hemiparesis. Nine patients had persistent hydrocephalus requiring ventriculoperitoneal shunt.

Conclusion: Conventional open transcortical approach is still effective in getting conclusive biopsy or near total excision of the lesion with minimum morbidity.

Key Words: Transcortical approach. Cyst. Intraventricular tumour.

INTRODUCTION

Tumours arising within the ventricular system of the brain are rare. Their incidence is approximately 1% of all intracranial tumours. They come to medical attention by either obstructing the flow of cerebrospinal fluid or after filling all the space available in the ventricular system. As no eloquent area is involved, they often present late. These lesions are mostly benign and slow growing and surgery is usually the best option of management. Usually these lesions are not radiosensitive and once diagnosed by imaging studies, complete successful removal of these lesion without increasing the pre-existing neurological deficit is the mainstay of treatment. Due to difficult access and poor visualization, the selection of appropriate approach to the ventricles is of fundamental importance.

The main surgical options include, open transcortical or transcorpus callosum approach, endoscopic resection and stereotactic biopsy or drainage of cystic lesions.

Neuronavigation / image guidance is a welcome adjunct specially in cases without hydrocephalus. While the current preferred method of treatment is endoscopic resection being minimally invasive, it requires considerable expertise to master and this facility is often not available in many places. Hence, even now, in most centres an open transcortical approach is used for resection of these lesions. The exact route is dictated by the complicated anatomy of the ventricles, size and location of the lesion and the presence of hydrocephalus. Transcortical surgery has the advantage of wide avenues and a more maneuverable microsurgical field and that a small portion of brain needs to be traversed from the cortex to the tumour. The disadvantage of this approach are the risks including apraxia, acalculia, visual and spatial distortion in the dominant lobe. Other reported complications of transcortical approach to intraventricular lesions are seizures, subdural collection, infection, hydrocephalus, haemorrhage, cerebral oedema electrolyte imbalance and death. One important complication of transcortical approach is damage to visual pathway resulting in temporary or permanent visual deficits.

The objective of this study was to describe the outcome of intraventricular tumours that were exclusively managed by open transcortical transventricular approach for establishing diagnosis and total resection wherever possible without causing further deficit.
METHODOLOGY

The study was conducted between January 2009 to December 2011 at the Department of Neurosurgery, Dow University of Health Sciences and Civil Hospital, Karachi. Data was collected in prospective manner. Study population included patients of all ages and either gender willing and fit for the said surgery, with provisional diagnosis of intraventricular tumour in the lateral ventricle and anterior third ventricle. Lesions predominantly within the ventricles were included. Patients with posterior third ventricle lesions and lesions predominantly in the brain parenchyma and hence not approached through the ventricle were excluded.

Provisional diagnosis was made on clinical assessment, supported by the radiological evidence. Pre-operative visual assessment and detailed neurological evaluation was performed for all patients who presented in outpatient clinics, although it was not possible in patients who presented with the poor neurological status in the emergency room. Antiepileptic medication were given as a loading dose pre-operatively. Patients were maintained on antiepileptic medicines for 3 months after the procedure or longer when they had pre- or post-operative seizures. After initial workup to optimize for surgery, all patients were operated on the first available elective list except those who were admitted in emergency with drowsiness due to associated hydrocephalus. They had an emergency ventriculostomy prior to surgery. All patients were operated through open trans-lateral ventricular approach, through the ventricular horn which provided the shortest trajectory to the lesion. The midline, anterior third ventricular lesions were accessed through the right frontal horn. Establishing diagnosis and total resection wherever possible without causing further deficit. A ventricular drain was left after surgery for 48 hours but was opened only if there was a symptomatic hydrocephalus. If the patient required a ventricular drain due to persistent hydrocephalus after 48 hours, a ventriculoperitoneal shunt was inserted.

Study variables included age, gender, presenting complaints, findings on clinical and neurological examinations, pre and postoperative radiology of brain, histopathological diagnosis, postoperative complications that included immediate (within 48 hours), delayed (upto two weeks) and late (up to six months postsurgery) complications. The patient's outcome analysis was simplified to three categories of good, fair and poor. Patients in whom the lesion was completely resected, who did not develop any postsurgical complications (except hydrocephalus) and improved in terms of neurological status were labeled as good outcome. Those patients in whom lesion could not be completely resected or who developed reversible complications such as infection, seizures, intraventricular haemorrhage, subdural collection or had transient neurological deficits were considered as fair outcome and the patients who developed permanent complications such as persistent neurological deficit or died were categorized as poor outcome. Data was collected by physician administered interviews and recorded on prescribed proformas designed for this research project and analysis was conducted with the support of Statistical Package for Social Sciences (SPSS) version 11 and Microsoft Excel. Statistical analysis includes simple descriptive statistics of the study variables using frequency and percentages for qualitative data and means with standard deviation for quantitative data. Data was delinked for patients identity and due care was taken for confidentiality of the records.

RESULTS

During the study period, 33 patients with intraventricular tumours underwent surgery through open (non-endoscopic) transcortical-transventricular approach. There were 23 male and 10 female patients in our series (male:female 2.3:1). Their age ranged from 10 months (choroid plexus papilloma) to 56 years (metastasis) having mean age of 26 ± 13.3 years. There was an almost even distribution in the first four decades but beyond that the number dwindled.

The predominant presentation was with features of raised intracranial pressure (Table I).

Table I: Salient clinical presentation (n=33).

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Number</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache and vomiting</td>
<td>29</td>
<td>87%</td>
</tr>
<tr>
<td>Altered consciousness</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>Visual disturbance</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Seizures</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Memory impairment</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Fifteen of the 33 lesions were in the anterior third ventricle/foramen of Monro. All of these were colloid cysts. One lesion (epidermoid) was in the body of third ventricle. Of the 6 lesions in the frontal horns, 4 were diagnosed as giant cell astrocytoma and 2 were diagnosed subependymoma on histology. Four lesions were predominately in the temporal horn but extended backwards into the occipital horn, 3 of these were choroid plexus papillomas and one meningioma. In 7 cases, the lesions were within the body of lateral ventricle. In 2 cases of central neurocytoma, the whole of the ventricular system was involved, in one of whom the extension was bilateral.

Fourteen out of 33 patients had a colloid cyst of the third ventricle; 4 each had choroid plexus papilloma and giant cell astrocytoma (2 of these latter had tuberous sclerosis). Two lesions were diagnosed as subependymoma at histopathology. Two patients had central neurocytoma, one of whom had presented 3 weeks after delivery. Her
lesion had extended into both ventricles and required two sessions of surgery for total clearance. One patient each had choroid plexus carcinoma, epidermoid, oligodendroglioma, cavernous hemangioma, metastasis, pilocytic astrocytoma and trigonal intraventricular meningioma.

It was possible to resect 29 out of 33 lesions at first surgery. Two lesions required surgery on two occasions (one central neurocytoma, one choroid plexus papilloma) and in 2 cases sub-total resection was performed (metastasis and oligodendroglioma).

Nine patients had persistent postoperative hydrocephalus and needed ventriculoperitoneal shunt. Three developed infection (ventriculitis), in 2 of whom infection was managed with aggressive antibiotic therapy. In 2 patients there was a postoperative neurological deficit; both improved with physiotherapy within 4 weeks. One patient developed intraventricular haemorrhage and subsequently a VP shunt. One patient had a large subdural hygroma, which resolved spontaneously. One patient died of severe ventriculitis leading to septicemia.

The overall outcome was labeled as good in 24 out of 33 cases (73%) and in 8 cases (24%) it was fair. One patient who died was categorized as poor outcome.

**DISCUSSION**

The largest number of patients in this series had colloid cysts. Approximately 0.5 – 3% of all primary brain tumours and 15 – 20% of all intraventricular masses are colloid cysts. The incidence (42%) in the present series emphasizes the general incidence. The management of these benign tumours is controversial when they present as incidental findings, but when they cause obstruction of the CSF, most neurosurgeons would recommend removal either endoscopically or by open method. After the cyst has been decompressed completely, its removal is essential to prevent its recurrence. Avoiding the fornix is important because unilateral fornix damage has been associated with amnesia (both anterograde and retrograde). In the current series, all colloid cysts were completely removed without causing any neurological deficit or affecting memory.

Choroid plexus papillomas account for approximately 0.5% of intracranial neoplasm in all age groups. In children, lateral ventricles is a common site of origin. In the present series, 4 patients had choroid plexus papilloma and one had a choroid plexus carcinoma. All patients of papilloma were in the paediatric age group. In 3 cases, the papilloma was large involving temporal and occipital horn and presented with features of mass effect. All lesions were successfully removed although in one case a second operation was required as the first surgery had to be abandoned due to massive blood loss.

Subependymal giant cell astrocytomas was present in 4 cases (12%), 2 of whom had tuberous sclerosis. Its reported incidence is 5 – 20% in patients of tuberous sclerosis. Current accepted treatment is surgical resection. However, other methods of treatment are being investigated. In all of the present cases, these lesions were completely removed without causing any deficit. Two patients had frontal subependymomas. These too were successfully resected.

Cavernous haemangiomas are usually found in the parenchyma of central nervous system. Their reported incidence in intraventricular location is 2.5-10.8% of cerebral cavernous haemangioma. In this series, this lesion was seen in one patient. It was radiologically reported as choroid plexus papilloma but was correctly diagnosed on histopathology. The lesion was completely resected without deficit.

Intraventricular meningiomas account for only 1% of the lesions. There was one case of meningioma that arose from ventricular trigone. This was successfully removed. Removal of trigonal meningiomas (TM) using the intraparietal sulcus approach without the aid of neuronavigational system have been reported. Central neurocytoma is a rare benign intraventricular tumour. It extends and fills the ventricular space before coming to attention with features of raised intracranial pressure. In one of the two cases of neurocytoma, lesion had extended and involved both ventricles and although at surgery it appeared that almost all of the lesion had been resected, postoperative scan showed a residual tumour. As these lesions are not radiosensitive, a second operation was performed to resect the residual lesion.

All of the anterior third ventricular tumours were colloid cysts which were successfully dealt with by a right frontal transventricular approach. In this series, the tumours in the frontal region were primarily giant cell astrocytomas, and subependymoma. However, earlier published data showed different proportion of tumour types. This frequency difference may be due to the small sizes of different series. Tumours of the frontal horn can become very large and cause obstruction of foramen of Monro. Tumours that extend inferiorly from the lateral ventricle into the third ventricle and require subchoroidal exposure for removal are better visualized when using a transcortical than a transcallosal approach.

When the overall outcome of management in this series is compared with that of the other series, it can be considered equal to or better than the data reported by Lee et al. (73% good recovery versus 51.2%). In that series, 14.6% of patients had severe disability and one patient ended in vegetative state. None of the patients in our series had such a poor residual outcome. The mortality rate too in our series was lower compared to aforementioned study (3% mortality vs. 7.3%).

Nine out of 33 patients in the present series required a ventriculoperitoneal shunt. This proportion is much
higher than other reported series. The reason for this probably is the policy of not maintaining ventricular drain after 48 hours to prevent the risk of ventriculitis.

A transcortical approach carries a significant risk of hemiparesis and language deficits. Postoperative visual field defects are also common especially with parietal and occipital approaches. In this series of patients, no new visual field defect was noted and the hemiparesis was transient. This could be attributed firstly to a more direct access to the lesion through the ventricular horn and second to the policy of minimal retraction during surgery.

Subdural fluid collection is a frequent postoperative finding in choroids plexus papilloma and reported surgical intervention rate in its management is 11%.15 In the present series, there was only one case of subdural fluid collection. This was managed conservatively and did not require surgery.

The key to a successful and effective transcortical surgery is an understanding of the functional anatomy, the location of the lesion and its blood supply. The complicated anatomy of the ventricles demands the surgical approach best suited to these principles. Similarly, incomplete excision, postoperative haemorrhage, infection and seizures are considered poor outcome parameters, whereas benign nature of the lesion, less operative time and gross total excision resulted in good outcome. In this series, the main poor outcome parameter was severe infection.

Although endoscopic surgery has become a benchmark in surgery of the intraventricular lesions with the limitations of endoscopic techniques only a small proportion of ventricular tumours can be safely removed by this method. The ideal lesion for total endoscopic resection is said to be the one which is soft, relatively avascular, almost entirely intraventricular, preferably less than 2 cm in diameter, has associated hydrocephalus and accessible through a straight trajectory.16 For this reason, there are only a few reports of pure endoscopic removal of large intraventricular lesions.

One major limitation of endoscopic tumour management is the requirement of intraventricular cerebrospinal fluid which is essential as a medium for image and light transmission. In patients without hydrocephalus, the neuroendoscopic procedures are difficult to perform because of presumed difficulties with ventricular cannulation.3 With open transcortical transventricular method, this difficulty is not encountered as once the ventricular plane is reached, the access around the lesion is easy.

Another limitation is the requirement of rapid debulking and haemostasis achieving tools through long narrow endoscopic channels. The painstakingly slow debulking with the current suction and resection methods alongwith limited haemostasis often requiring repeated irrigation makes surgery often difficult and prolonged. Recent introduction of newer tools such as the ultrasonic aspiration system that fits into neuroendoscopes appears promising.17 The disadvantages of an endoscopic biopsy are the risk of bleeding from a vascular tumour or ventricular ependyma while obtaining a biopsy and the failure to obtain a representative sample of tumour tissue due to the extreme variability of its character in different parts of the tumour substance.18,19

In endoscopic procedures, endoscopic third ventriculostomy, currently is the procedure of choice for hydrocephalus. In addition to avoiding potential long-term complications of shunt, it has the added attraction of achieving CSF diversion at the time of definitive endoscopic procedures.20,21

Endoscope assisted microneurosurgery combines the benefits of both techniques and appears to be the technique of choice in endoventricular tumours.22 Transcortical approach is a simple approach for many deep seated ventricular lesions and is the approach of choice with some lesions such as those in the temporal horns and in atrium of lateral ventricle. With a carefully performed microsurgical procedure, the risks are much less than is generally believed.1

**CONCLUSION**

Conventional open transcortical-transventricular approach even with the advent of image guidance system and endoscope still remains an adequate method of management of intraventricular lesions in order to get conclusive biopsy or to achieve near total excision which is often the treatment of choice for these mostly benign lesions.

**REFERENCES**


