ORIGINAL ARTICLE

Increasing the Implication of Endoscopy to a Wide Spectrum of Intraventricular Lesions: A Review of Our Experience

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ABSTRACT

Introduction: *Though traditional microsurgical techniques are the gold standard for intraventricular tumor resection, the morbidity and invasiveness of microsurgical approaches to the ventricular system have galvanized interest in neuroendoscopic resection. We present a case series to share our experience with endoscopic management of intraventricular lesion.*

Materials and Methods: *17 patients, both male and female, from 5 to 50 years of age were endoscopically operated during 1.5 years. Intraventricular lesions < 4cm, mildly vascular and soft in consistency were included. The average operative time was 90 minutes and the average hospital stay was 4 ± 1.5 days. Follow up was done at 2 weeks, 6weeks and at 6 months.*

Results: *Out of 12 males and 5 females there were 6 colloid cysts, 3 supra sellar arachnoid cysts, 5 intraventricular tumors and 3 pineal tumors. Complete resection of lesion was achieved in 4 out of 6 patients with colloid cyst (66.6%). Size of supra sellar arachnoid cyst reduced along with improvement of hydrocephalus in all 3 patients (100%) Positive tumor biopsy was possible in 100% of cases. Adjuvant endoscopic third ventriculostomy was performed in 9 (52.9%). Septostomy was done in 1 (5.9%). Post op Ventriculoperitoneal shunt was required in 4 (23.5%) cases. There was no peri or post operative mortality.*

Conclusion: *With proper patient selection endoscopic surgery can yield results at par with microsurgery with added benefits of minimum patient discomfort, shorter hospital stay and improved cosmetic results.*

Key word: *Intraventricular tumor, colloid cyst, arachnoid cyst, pineal tumor, ventriculostomy, septostomy.*

INTRODUCTION

Over the last few decades, the concept of minimally invasive surgery has gained outspread acceptance. The emphasis on minimum surgery related morbidity and access to advanced surgical adjuncts has led neurosurgeons to stir away from conventional craniotomies.[1] Although microscopic surgery remains gold standard in most intracranial pathologies,[1,7,8] the invasiveness of microsurgical approach to ventricular system has spur interest in neuroendoscopy.[1]

Intraventricular lesions do not always require aggressive surgical resection since some lesions are best treated with radiation therapy. Endoscope can be employed to obtain tissue samples for diagnosis and sometimes a complete tumor resection can be achieved.[2] A simultaneous CSF diversion can be performed sparing some patients a permanent shunting procedure.[2]

The large majority of data in the neurosurgical literature originate from studies of endoscopic colloid cyst resection.[11] Data regarding endoscopic resection of other intraventricular tumors exists primarily in case reports and small series because of rudimentary nature of endoscopic instruments and a steep learning curve involved.[1]

The goal of this report is to share our experience with endoscopic management of intraventricular lesions.

MATERIALS AND METHODS

18 patients, both male and female, from 5 to 50 years of age were endoscopically operated during 1 year from January 2015 to January 2016 in the department of neurosurgery unit III, Lahore General Hospital Lahore.

Table 1: *Demonstrating inclusion and exclusion criteria.*

Inclusion	Exclusion
Intraventricular Tumors	Small Ventricles
Small size < 4 cm	Calcified Lesion
Mildly Vascular	Lesions in 4^{th}
Soft consistency	

All patients were admitted from outpatient department. Thorough clinical evaluation was done in each. Imaging studies included a chest x-ray, plain CT brain and MRI brain with gadolinium contrast. Each patient's presenting symptoms, clinical and radiographic findings, treatment, histopathology, outcome, and complications were recorded.

All patients were operated endoscopically under general anesthesia in a supine position. Preoperative antibiotics and prophylactic antiepileptics were always administered. Ventricular access was most commonly attained through a right-sided approach (except in 1 case with asymmetric left-sided ventriculomegaly, in which case a left-sided approach was preferred). The burr hole was most commonly placed at some variant of Kocher's point. 0° degree rigid endoscope with Lota system was used. Cortical access site was plugged with sponge stone and layered closure of the wound was done in all. Neuronavigation was not used. The average operative time was 90 minutes and the average hospital stay was 4 ± 1.5 days.

Follow up was done at 2 weeks, 6weeks and at 6 months.

RESULTS

We performed endoscopy in 17 patients, 12 males and 5 females. There were 6 colloid cysts, 3 supra sellar arachnoid cysts, 5 intraventricular tumors and 3 pineal tumors.

Table 2: *Number of cases operated and mean age at the time of presentation.*

Cases	No. of Patients	Mean Age	Percentage
Colloid Cyst	6	37 (±13.6 SD)	35.3%
Arachnoid Cyst	3	8 (± 2.9 SD)	17.6%
Intraventricular Tumor	5	(28 (± 9.9 SD)	29.4%
Pineal Tumors	3	19 (± 2 SD)	17.6%

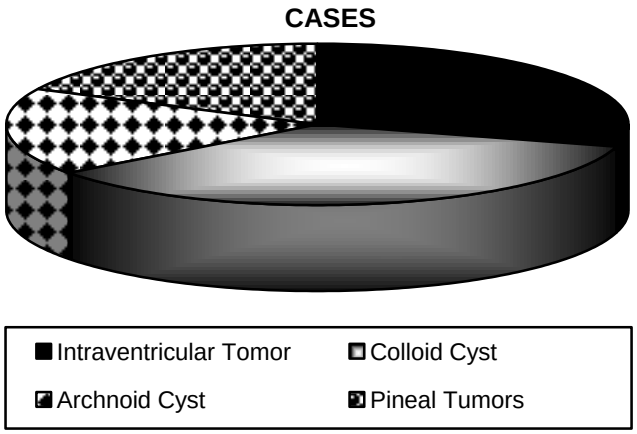


Fig. 1: *Percentage of each intraventricular lesion out of 15 cases.*

Headache, vomiting and ataxia were the most common presenting complaints. Most common location of colloid cyst was the roof of the third ventricle, blocking foramen of monro on one or both sides. All 3 arachnoid cysts were suprasellar extending into the third ventricle. Intraventricular tumors were located around foramen of monro and third ventricle. Preoperative hydrocephalus was present in 14 patients (82.3%). One patient had small ventricles in which case saline insufflation was used to enlarge the ventricles. Adjuvant endoscopic third ventriculostomy was performed in 9 (52.9%). Septostomy was done in 1 (5.9%). Post op Ventriculoperitoneal shunt was required in 4 (23.5%) cases, including 2 patients with low grade astrocytoma in whom ETV was not possible because tumor obscured the third ventricle. Complete resection of lesion was achieved in 4 out of 6 patients with colloid cyst (66.6%). Size of supra sellar arachnoid cyst reduced along with improvement of hydro-

cephalus in all 3 patients (100%) Positive tumor biopsy was possible in 100% of cases. Tumor bleed occurred in 1 patient with highly vascular lesion that later turned out to be GBM. EVD was kept in place in that patient for 48 hours and was later converted to ventriculoperitoneal shunt. ETV failed in 1 patient with pineal tumor who continued to show signs of raised ICP post op and was subsequently operated for VP shunt. Overall 1 complication was encountered (5.9%). Good Glasgow outcome score (4 – 5) was achieved in 88.2%. Patients with fair outcome 11.7% (GOS 3) had low GCS at presentation. There was no peri or post operative mortality. At 6 months no recurrence in colloid and arachnoid cyst was observed on follow-up.

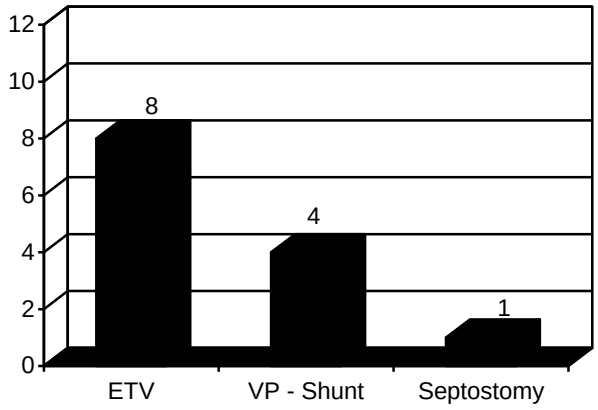


Fig. 1: *Demonstrating the type and number of CSF diversion procedures performed.*

DISCUSSION

Neuroendoscopy was adopted initially by Dandy in 1922 and others as an innovative means of treating hydrocephalus[2]. In 1963, Guiot et al from France reported its use in a patient with a colloid cyst. In 1973, Fukushima et al from Japan first reported endoscopic biopsy of an intracranial lesion.[2] Advances in fiber optics and adjuncts like neuronavigation have broadened the spectrum of endoscopy in the brain.

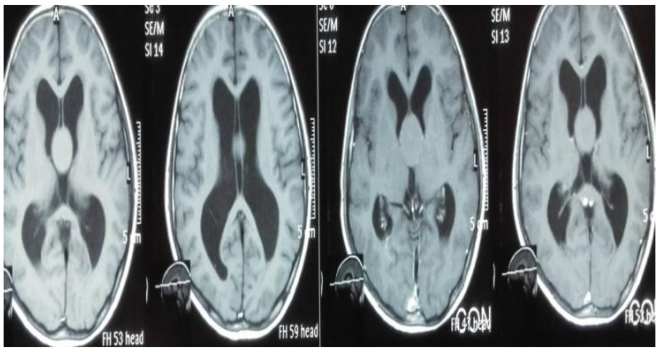
Endoscope can provide a way about some of the challenges encountered with intraventricular tumor surgery. Intraventricular lesions tend to be anatomically remote and difficult to approach with conventional microsurgical techniques requiring extensive tissue dissection and retraction. Neuroendoscope provides an easy access and better visualization of the ventricular system and lesions therein.[11]

Intraventricular lesions are associated with preoperative hydrocephalus in 84.1% of the cases[1] (82.3% in our study). Neuroendoscopy provides a surgeon an opportunity to perform concomitant CSF diversion in such cases, saving patient from dependence and complications associated with a permanent shunting device.

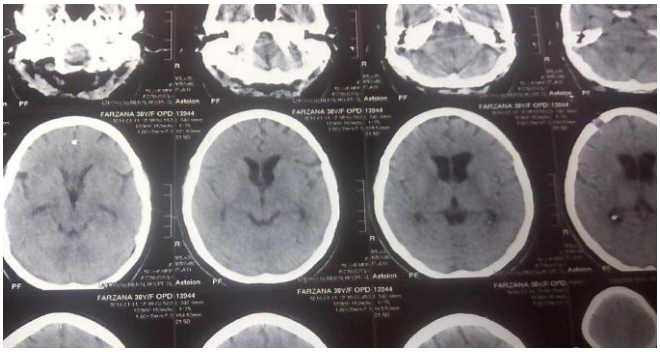
Neuroendoscopy however has limitations due to fairly rudimentary tools available for endoscopic use. The primary tools for dissection, resection and hemostasis are rather elementary including forceps, suction and bipolar cautery. Endoscopic methods for acquiring timely hemostasis are also lacking and visualization through the endoscope is largely compromised in the setting of active uncontrolled hemorrhage. Assistive

Table 3: *Demonstrating tumor histology, number of cases, pre-operative hydrocephalus, procedure performed on each case, adjunctive procedure, complications encountered in each case and final outcome.*

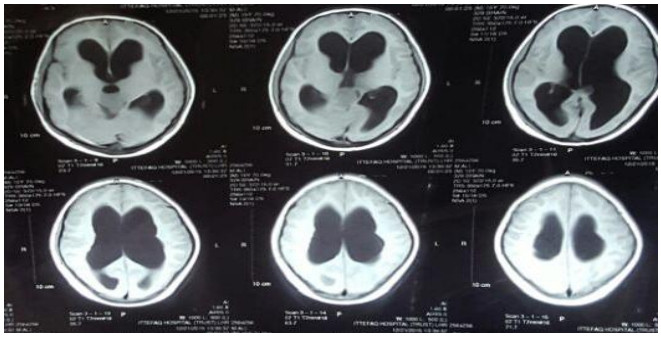
Tumor Histology	No. of Patients	Pre-operative Hydrocephalus	Procedure	ETV/Septostomy	Complication	Outcome GOS
Colloid cyst	6	+ve (5)	Resection (4) Aspiration (2)	ETV	None	5 (6)
Arachnoid cyst	3	+ve (3)	Ventriculocysto-cisternostomy	None	None	5 (3)
Low grade Astrocytoma	4	+ve (2)	Biopsy	None	None	5 (2) 4 (2)
GBM	1	+ve	Biopsy	Septostomy	Tumor bleed	3 (1)
Pineoblastoma	2	+ve (2)	Biopsy	ETV	None	3 (1)
Germinoma	1	+ve	Biopsy	ETV	None	4 (1)



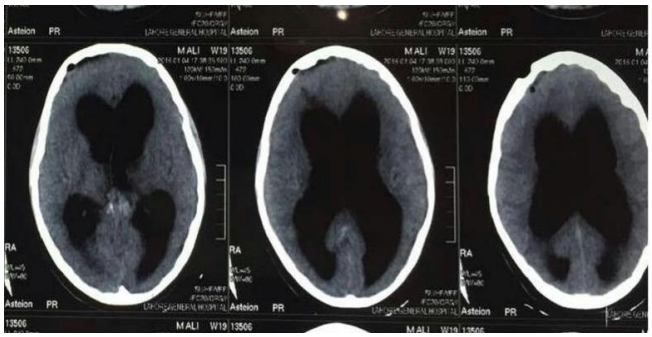
Colloid Cyst Pre-operative.



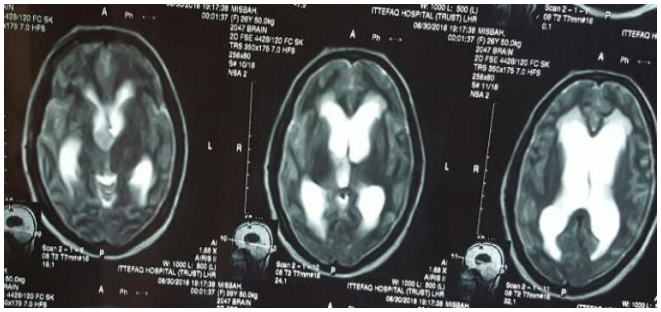
Colloid Cyst Post-operative.



Pineoblastoma Pre-operative.



Pineoblastoma Immediate Post-operative.



Intraventricular Low Grade Glioma.

devices (CUSA, micro ENP ultrasonic hand piece, Suros device and NICO myriad aspirator) have been used by some authors to aid endoscopic resection but they are not available readily in every centre and there is lack of objective data supporting their overall benefit.[1]

The current consensus suggests that ideal lesions for endoscopic approach are those having small size (≤2cm), soft consistency, mild to moderate vascularity, low histological grade, located completely inside the ventricle, associated hydrocephalus and accessible through a straight trajectory.[2] Endoscopic biopsy is considered for any intraventricular lesion if pre operative diagnosis includes pathological entities that are amenable to neoadjuvant therapies and do not require aggressive surgical resection. (e.g., pineal tumors, CNS lymphomas, disseminated metastasis and gliomas).[2]

Complications include permanent memory loss, infection, mutism, cerebrospinal fluid leak, intraventricular hemorrhage, Tumor bleed and trochlear palsy.[12]

Boogaarts et al,[13] operated 90 colloid cysts endoscopically and reported a complete/near complete resection in 57.5% (compared to 66.6% in our study) and a recurrence in 26.6% (compared to 0 in our study). Sean M Barber[1] reviewed 21 studies and reported 80.2% complete or near complete resection, 14.9% complication and 9.8% recurrence rate in endoscopically managed colloid cysts.

EL-Ghandour NM[5] reported a 100% improvement in size of supra sellar arachnoid cyst, 85.7% improvement in hydrocephalus related symptoms and no complications in 14 patients after endoscopic ventriculocystocisternostomy (comparable to 100% success rate and no complication in our study). Gangemi M et al,[6] reported a cure rate of 90% in 102 patients with supra sellar arachnoid treated endoscopically.

Morgenstern PF[4] reported a positive tissue yield in

86.7% and no complication in 15 patients who underwent endoscopic biopsy and simultaneous third ventriculostomy for pineal tumors. Yamini et al[3]. reported a positive tissue diagnosis in 89%, need of permanent shunt in 15% and transient complication in 15% out of 54 cases of pineal tumors undergoing endoscopic biopsy (compared to 100% tissue diagnosis and 33.3% shunt dependency in our study).

In a study on complications of endoscopic brain surgery, Peretta et al[14] reviewed 450 patients who underwent endoscopic procedures over a 10 – year period. Nineteen of these procedures were for tumor biopsy, 2 of these had complications (1 diffuse brain swelling and subsequent death and 1 subdural hematoma). Depreitere et al[15] reported 9.6% hemorrhages in 31 patients who underwent endoscopic brain tumor biopsies (compared to 5.9 % in our study).

With endoscopic intervention gross total resection rates of 71 – 100% [9] and complication rate of 0 – 25%[9,12] (compared to 80.4 – 96% and 4.3 – 29.3% respectively for microsurgical intervention)[10] can be achieved in selected cases.

CONCLUSION

With proper patient selection endoscopic surgery can yield results at par with microsurgery with added benefits of minimum patient discomfort, shorter hospital stay and improved cosmetic results. However, there is a need to further develop endoscopic technology, dissection tools and means for achieving prompt hemostasis.

Microsurgical resection remains the gold standard for intraventricular lesions.[7,8] Endoscopic applications in the treatment of CNS pathology, however, continue to expand.

We are on the cusp of a new revolution in Neurological Surgery. Major advances have been made in neurological surgery in last couple of decades and we in Pakistan are catching up. Our enthusiasm towards minimally invasive surgery will eventually be beneficial for more and more patients in future.

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