

Evaluation of Resectability, Surgical Approaches And Out Come of Intraventricular Tumors--A Prospective Study

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Abstract:

Aims & Observations: To study clinical characteristics, presentation, surgical approaches, resectability and surgical out come of intra ventricular tumors

Materials & Methods: Patients age ranging between minimum of 1 Year to maximum of 43 yrs.

Most of them presented with raised ICP (15), Seizers (8), Visual disturbances (6).

CT& MRI are the main diagnostic modalities, Surgical approach and resection was based on location of tumor. In our study in 13 patients tumors are located in lateral ventricles and another 13 patients in 4th ventricle and 12 patients in 3rd ventricle.

3rd ventricle tumors were approached via the tarsn callosal approach, endoscopic and combined. Transcortical route was used for tumors of the lateral ventricle and suboccipital route was used for the 4th ventricular lesions. Outcome depended on the size of the lesion, the pre op morbidity status and the approach used for the lesion.

Conclusion: For small 3rd ventricular tumors, tarsncallosal approach is ideal, but for larger lesions and lesions of lateral ventricles, the transcortical approach was better the in terms of intra operative visualization of the lesion and the completeness of excision, and thereby shows a better outcome. Most postoperative morbidity and mortality were due to hematoma/hydrocephalus.

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I. Introduction

Intraventricular tumors comprise a heterogeneous group of neoplasms with regard to tumour type and clinical prognosis in both children and adults, arising within and proximity to the ventricular system. Although some of these tumors are aggressive, high grade lesions, many are histologically benign and potentially curable by undertaking resection, If left alone some of the benign tumors like colloid cyst of the third ventricle can cause serious morbidity and even sudden death (1)

II. Incidence

Intraventricular Tumors Account for one tenth of all Intracranil Neoplasms(4). Choroid plexus papillomas account for 2-5%* of all intracranil neoplasms, Colloid Cyst 0.5-1% (6,7), Pineal Cyst 0.4-1% (8), Craniopharyngeomas 1-2%, PNET 2-3%, Meningiomas 2%, Juvenile pilocytic astrocytomas 5-10%, Subependymal giantcell astrocytoma occur in 10-15% of patients with tuberous sclerosis. All these Tumors are more common in males than in females, Germinomas and Pineal tumors have strong male predominance. Intra ventricular meningiomas have no female predominance (11), unlike in other locations.

Table 1 Supratentorial intraventricular neoplasms by location*

Location	Tumor
lateral ventricles	
trigone	CPP, ependyoma, meningioma
body	astrocytoma, PNET teratoma
FH/SP	SGCA, PA, PNET
third ventricle	
FOM/ant 3rd ventricle	PA, eraniopharyngioma, germimoma CPP colloid cyst
FOM pos 3rd ventricles germ cell	pineal, high-grade astrocytoma, ependymoma,

CPP = Choroid Plexus Papillome. PNET = Primitive Neuro Ectodermal tumors

*ant= anterior, FH/SP= frontal horn/septum pellucidum : FOM = foramen of Monro, PA= pilocytic astrocytoa: pos= posterior SGCA=subependymal giant cell tumor.

III. Investigations

3.1 X- Ray

Calcification is seen in craniopharyngiomas 90%, chroid plexus tumors25%, ependymomas50%, tuberous sclerosis, meningiomas25% and PENT's. Dilated 3rd ventricle amputates, dorsumsellae. LIN et al (25) reported that 75% of pinela tumors in his series showed pineal calcification, the pieneal gland was abnormal in size in 21%, and in an abnormal position in 67%, displaced posteriorly and inferiorely.

3.1 CT Scan and MRI

Both will demonstrate the mass of the tumor, outline the ventricular system and show where the tumor obstruct CSF spaces. The various MRI sequences often allows definition of cystic portions, mixed dens lesions like craniopharyngiomas. MRI will be useful to study the relationship of the tumor to the optic chiasm pituitary stalk and basilar artery in case of anterior 3rd ventricular tumors, and venous anomalies around the vein of Galen. MRI can aid in the definition of tumor seedling to other portions of the nervour system.

Table 2 Imaging characteristics of common intraventricular tumors

Neoplasm	CT Characterists		Enhancement	MR imaging Characteristics	
	density	calcified		T1 intensity	T2 intensity
CPP	Iso-hyper(3/4)	25%	+++	Hypo	iso-hyper
CPC	Iso	25%	+++	hypo	iso-hyper
astrocytoma	iso	15-20%	+	hypo	hyper
SGCA	mixed (iso hypo)	common	+++	hypo-iso	iso-hyper
ependymoma	iso	(50%)	++	hypo	hyper
meningioma	hyper	(20-25%)	+++	iso	
PNET	hyper	common	+	hypo	hyper
central neurocytoma	iso-hyper	yes	++	iso-hyper	
germinoma		hyper	uncommon	+++	iso-hyper
teratoma	mixed	yes	-	mixed	mixed
craniopharyngioma	hyper	yes(9-%rim	+++	hypo	
colloid cyst	iso (1/3)	no	rim	hyper	hyper
	hyper (2/3)				
Pineo blastomas	hyper	common	+++	hypo-iso	hyper
medulloblastomas	iso-hyper	common	++		

3.2Angiography

Useful in identification of aneurysms, A-V malformations, abnormalities of vein of Galen, and meningiomas. Pre operative information about the relationship of the internal cerebral veins, vein of Galen, basal vein of Rosenthal, precentral cerebellar vein to the lesion. Information which can be important in planning surgical approach.

3.3Analys of CSF & Serum biological markers

Although not specific for cystological classification of tumors, These are useful as baseline study for the evaluation of tumor dissemination and effectiveness of multi modality therapies. CSF Cytology is useful in diagnosis of all intravaentricular tumors. Beta HCG, Alfa fetoprotein determinations are also useful in monitoring, the effectiveness of therapy in those patients with Germcell tumors. Those patients treated surgically these markers return to normal. Subsequent elevation indicates recurrence.

IV. Clinical Features

Headache due to raised ICP is th most common symptom. Most of these patients present with hydrocephalus which is often obstructive and unilateral. Head ache (which can be unilateral) gait disturband and cognitive changes are the hallmarks of hydrocephalus generally in classical hydrocephalus there is split in the verbal I.Q compared with performance I.Q. Lesions arising from the thalamus tend to present with hemi perisis and paradoxically to a much lesser extent sensory deficits. Lesion in the atrium and occipital horn are susceptible

to visual deficits.

3rd ventricular lesions (30). seizures have been reported in approximately 20% patients with

Table 3: Endoscopic approach for different tumors.

Tumor Locations	Entry point
Lateral ventricle- frontal horn	2-3 cms parasagittal, coronal to 2 cms precoronal.
Lateral ventricle - cellamedia	2-3 cms parasagittal, coronal to 2cms precoronal.
Lateral ventricle - trigone	2-3 cms parasagittal, 4-6 cms precoronal.
Foramen of monro	3-5cms parasagittal, 2-4cms precoronal.
anterior 3rd ventricle	1-2 cms parasagittal, coronal.
posterior 3rd ventricle	1-2 cms parasagittal, 4-6cms precoronal.

V. Stereo Tactic Procedures

Bosch et al 1975 reported four cases treated by stereotactic procedure and aspiration of colloid cyst (35). Negligible morbidity and a preserved permanent good effect has been claimed as a result of this procedure for benign lesions like colloid cyst. Waller a hall et al (1987) concluded in their study stereotactic aspiration was recommended as the initial treatment of choice for colloid cyst of 3rd ventricle. Mathiesen et al proved in the study the failure to achieve permanent reduction of lesions and symptomatic hydrocephalus, need for repeated aspirations. This procedure is also useful in managing cranio phringiomas in younger children in whom radiotherapy is contraindicated.

VI. Clinical Methods & Materials

A Prospective study of 38 cases between NOV 2006 – NOV 2014. 38 cases of intraventricular tumors were operated during this period. Total 780 cranial tumors were operated during this period, this constitutes 4.87%. Of 38 cases there were 23 males, 15 females M : F (1.5 : 1) This include 32 patients age below 30 years, age ranging between minimum of 1 year to maximum of 43 years.

Table 4: Age distribution

1-10	9
11-20	14
21-30	8
31-40	6
41-50	1

Duration of symptomatology 1 month to 1 yearThe main clinical symptoms were head ache with raised Icp 45%, convulsions 20%, visual impairment 15%, limbs incoordination 10%.In our study 13 tumors arising in the lateral ventricles (8 on left side), 12 in the 3rd ventricular region, 13 in the 4th ventricle.

VII. Operative Treatment

All 38 patients underwent surgery. The goal of surgery in case of lateral ventricular and fourth ventricular and benentumors of third ventricle like colloidcysts and craniopharyngiomas is total removal of the tumor and in case of malignan tumors of third ventricle is achieving histological diagnosis to direct further surgery and adjuvant therapies. But total removal could not be performed in all cases, the reason being

1. to accommodate existing neurological deficits.
2. deliberate incomplete resection for tumors located deep which are difficult to remove totally , which carry high mortality and morbidity because close to major neurovascular structures.
3. Technical difficulties.
4. Anaesthesia and patient related complications.

Complete resection is done for tumors of lateral ventricles, colloid cyst of 3rd ventricle and tumors of 4th ventricle.Bone flap removal done in 1 patient due to intraoperative brain swelling.

1.Complete resection	31	(81.5%)
2.Incomplete resection	07	(18.4%)

All lateral ventricular tumors approach through anterior transcortical, transventricular approach. 4 among 6 craniopharyngiomas operated through pterional transylvian approach. Remaining 2. craniopharyngiomas, 2 colloid cyst and 1 astrocytoma resected through transcortical, transventricular approach. Among 3 pineal region tumors, 2 were operated through posterior transcortical approach and 1 through supracerebellar, infratentorial route. All 4th ventricula tumors operated through the midline posterior sub occipital craniectomy.

Complications : Post operative convulsions being the commonest complication occurred in 8 patients, infection in 6, CSF leak four, meningitis 4, limb peresis 1.

Table 5 Histopathology

Lateral Ventricular Tumors :	Total No.	3rd Ventricular Tumors	Totl No.
Choroid plexus papillomas	- 4 (10.5%)	Craniopharyngiomas	-6 (15.7%)
Astrocytomas	-3 (7.8%)	Colloid Cysts	-2 (5.2%)
SEGA	-1 (2.6%)	Germinomas	-2 (5.2%)
Neurocytomas	-4 (10.5%)	Pineocytomas	-1 (2.6%)
Ependymomas	-1 (2.6%)	Astrocytomas	-1 (2.6%)
4th Ventricles Tumors			
	Total No.		
Astrocytomas	-3 (7.8%)		
Medilloblastomas	-4 (10.5%)		
Ependyomomas	-5 (13.1%)		
Epidermoid	-1 (2.6%)		

For all malignant tumors radiotherapy was advised. as an adjuvant therapy after surgery.

7.1 Follow up

The follow period is one month to 4 1/2 years. During this period patients were evaluated clinically and in some cases repeat CT san brain done to know recurrence, and residual tumor. We had 1 case of recurrent astrocytoma of 4th ventricle in our study, which was re-operated. However follow period is short to discuss about recurrence rate.

VIII. Discussion

This is a prospective study of period 8 years. Total of 38 cases of intraventricular tumors operated. During the same period a total of 780 primary intracranial tumors were operated. Thus intraventricular tumors comprises 4.87% of all primary intracranial neoplasms. The male : female ratio in this study is 1.5 : 1. A study from Sri Chitra Tirunal Institute has revealed M : F ratio of

1.64 : 1. The lower percentage of female population in our series most likely due to cultural phenomenon like illiteracy, lack of independency, poverty, neglect of health related problems etc.,

The incidence of intraventricular tumors is common in younger (less than 30 years) age group (32 patients - 84.2%). A study from UCSF has also shown same finding.

Peak age of presentation is 43 years with mean age of 14 years. SCTIMS study has shown mean age 21.5 years. 1 case of tuberous sclerosis presented with sub ependymal giants cell astrocytoma was operated in this series.

Table 6 Comparison of Clinical Presentaion

	GGH KAKINADA	SCTIMS
Raised Icp	45%	50%
Seizers	20%	25%
Visual Disturbances	16%	29%

* SCTIMS = Sri Chitra Tirunal Institute of Medical Sciences

The commonest initial presenting symptom is headache 40%, followed by seizers 20% in lateral ventricular tumors. Paroxysmal headache was the presenting symptom in one case. Other symptoms being Visual disturbances 15% and limbs incoordination 10%. Papalloedema was the commonest clinical sign 30%. The high percentage of headache as initial complaint may be due to other symptoms initially considered as nonspecific. Normal clinical examination is noted in 8 patients. The most important diagnostic modality in our series is CT scan brain. All the patients underwent both plain and contrast enhanced CT scan brain. Very few patients underwent MRI scan of brain. CT plays a major role in a establishing the diagnosis and location of intraventricular tumors. CT will permit an earlier diagnosis and very cost effective. But MRI has multiplanar imaging capability with better anatomical details, especially useful to plan surgery in complicated anatomical regions like, third ventricular tumors. In our study, CT scan of brain is the diagnostic modality. The reasons being, CT scan gives almost all the information needed for planning surgery. CT scan is more economical investigation

compared to MRI, where most of our patients cannot afford. In our study, CT scan is neither helpful in preoperative prediction of histological type nor the tumor vascularity. None of our patients underwent angiography. Angiography is considered useful to serve as road map for surgery. In our study in 13 patients tumors are located in lateral ventricles and another 13 patients in 4th ventricular and in 12 patients in the 3rd ventricular. Among 13 patients of lateral ventricular tumors 70% were on left lateral ventricle. This is comparable study from SCITMS which has also shown left side predominance. Hopper et al from Kingsten Hospital Canada proved in his study that most of the lateral ventricular tumors are common in left lateral ventricle. All 38 patients underwent surgery. The goal of surgery in case of lateral ventricular and fourth ventricular and benign tumors of third ventricle like colloidcysts and craniopharyngiomas is total removal of the tumor and to establish normal CSF pathway in case of malignant tumors of third ventricle is to decompress the neurological structures and to establish normal CSF pathway and achieving histological diagnosis to direct further surgery and adjuvant therapies. But total removal could not be performed in all cases, the reason being

1. to accommodate existing neurological deficits.
2. deliberate incomplete resection for tumors located deep which are difficult to remove totally, which carry high mortality and morbidity because close to major neurovascular structures.
3. Technical difficulties. 4. Anaesthesia and patient related complications.

The most common post operative complication is convulsions in 8 patients.

Table 7 Comparison of Histopathology

NAME	GGH KAKINADA	UCSF	SCITMS
Choroid plexus papillomas	10.5%	2.7%	12.3%
Astrocytomas	7.8%	13.6%	16.9%
SEGA	2.6%	1.3%	21.5%
Neurocytomas	10.5%		18.4%
Ependymomas	2.6%	12.7%	7.6%

NAME	GGH KAKINADA	UCSF	SCITMS
Craniopharyngiomas	15.7%	6.8%	4.1%
Colloid Cysts	5.2%	13.6%	7.2%
Germinomas	5.2%		0.4%
Pineocytomas	2.6%		
Astrocytomas	2.6%	5.4%	12.9%

NAME	GGH KAKINADA	UCSF
Astrocytomas	7.8%	1.3%
Medulloblastomas	10.5%	5.4%
Ependyomomas	13.1%	5.4%
Epidermoid	2.6%	4.1%

Table 8 Comparison of Mortality

Name	GGH KAKINADA	SCITMS
Lateral Ventricular Tumors	7.6%	12.5%

Name	GGH KAKINADA	Sweet & Schmidek
Craniopharyngiomas	0%	0%

Name	GGH KAKINADA	Nimhans 1980 - 1993
Colloid cyst	0%	9%

Name	GGH KAKINADA	Sweet & Schmidek
Craniopharyngiomas	0%	0%

Name	GGH KAKINADA	Naidich et al
Infratentoria ependyomomas	0%	14%

Name	GGH KAKINADA	Bloom & Mealey
Midulloblastomas	0%	10-11%

Table 9 Comparison of Complications

NAME	GGH KAKINADA	SCITMS
Seizers	3.2%	12.5%
Limb Perisis	2.6%	16%
Mental Changes	5.6%	20%
Meningitis	10.5%	
Wound Infection	15.7%	

Shunt surgery was done for 6 patients.

None of our patients underwent endoscopic surgery due to lack of facilities.

Radio therapy was given for all malignant tumors, as an adjunct therapy

The management of intraventricular tumors remains a major challenge to neurosurgeons. With the advance of better imaging technique, tumors are identified earlier. Surgical technique using operative microscope, intra operative monitoring facilities and improved understanding of anatomy will allow tumor to be resected with better results.

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