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A diversity of central nervous system tumours at a tertiary care centre-a one year prospective study

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Abstract

Introduction: Central nervous system tumours represent unique heterogenous population of neoplasms which include both Benign and Malignant neoplasms. In India, CNS tumours constitute about 1.9% of all the tumours. These tumours pose diagnostic difficulty due to varied presentation and overlapping morphological features. Immunohistochemistry helps in overcoming diagnostic difficulties in problematic cases.

Aims and Objectives: The aim of the study is to analyse histopathological spectrum of CNS tumours irrespective of age in a single institution.

Materials and Method: A one year prospective study was carried out in department of pathology from 2016 to 2017, at the department of pathology, ASRAM. Neurosurgical specimens were formalin-fixed and paraffin-embedded and stained with Haematoxylin and eosin. Immunohistochemical markers were applied in selective cases like S-100, CD-45, etc.

Results: In our study, seventy two (72) brain neoplasms were analysed. Neuroepithelial tumours (25) were most common, followed by meningothelial tumours (22), tumours of sellar origin(12), tumours of cranial and paraspinal nerves(5), metastatic tumours(4) and others (4).

Conclusions: The present study highlights the histological diversity of CNS tumours in various age groups. CNS tumours peak incidence was noted at 4th to 5th decade. Meningiomas and astrocytomas were common tumours after 40 years of age. GBM was the most common among astrocytomas. Immunohistochemistry was helpful in dilemmatic cases.

Keywords: Central, Nervous, System, Tumours.

Introduction

Central nervous system tumours represent a unique heterogeneous population of neoplasms, include both benign and malignant neoplasms. They vary widely in terms of site of Origin, morphological grouping, location, presenting features, growth potential and tendency for recurrence. These intracranial tumours comprise a relative small percentage of malignancies globally and have particular significance due to their associated severe morbidity and mortality.(1)

In India, tumours of the CNS constitute about 1.9% of all tumours.(2) The age distribution of CNS tumours is said to be bimodal. Males are involved more frequently, meningiomas being exception.

The World Health Organization (WHO) classifies into seven categories.(1)

1. Neuroepithelial tumors,
2. Tumors of meninges,
3. Tumor of cranial/spinal nerves,
4. Germ cell tumors,
5. Tumors of sellar region,
6. Lymphoma/Hemopoetic neoplasm,
7. Metastasis.

Neuroepithelial tumours are further classified into:

1. Astrocytic tumours,
2. Oligodendroglial tumours,
3. Oligoastrocytic tumours,
4. Ependymal tumours,
5. Choroid plexus tumours,
6. Neuronal and mixed neuronal glial tumours,
7. Tumours of pineal region,
8. Embryonal tumours.

Tumours of meninges

1. Meningothelial tumors
2. Mesenchymal tumours
3. Primary melanocytic lesions
4. Other neoplasms related to the meninges (Haemangioblastoma)

Materials and Method

A one year prospective study was carried out from June 2015 to June 2016, in the department of Pathology, at our institute Asram medical college, Elluru. Neurosurgical specimens received were formalin-fixed, paraffin-embedded and stained with Hematoxylin and Eosin. Immunohistochemical markers like S-100, CD-34 etc. were used wherever required. The tumours were classified according to WHO classification and WHO grading was applied.

Results

The age of patients ranged from 4years to 75 years. The mean age of 43.2years. The maximum number of cases seen were in the age group of 40-49 years, followed by 50-59 years (Table 5). The least number of cases were in the age group of 10-19 Years observed in this study. Youngest case was four years for

ependymoma (Table 5). Oldest case was 78 years for Glioblastoma Multiforme.

Table 1: Distribution of CNS Tumours

	Distribution on CNS tumors	Percentage
1.	Intracranial tumors	60(83.3%)
2.	Spinal tumors	12(16.7%)

Table 2: Patterns of tumours based on origin

S. No	Patterns of tumors based on origin	Percentage
1.	Primary CNS tumors	68(94.4%)
2.	Metastasis	4(5.6%)

Table 3: WHO Grading of Tumours

S. No	WHO Grade	Total No. Cases (n=68)	Percentage
1.	I	35	56%
2.	II	9	14%
3.	III	5	8%
4.	IV	14	22%

Table 4: Age wise distribution of CNS Tumours (0-19Yrs)

S. No	CNS tumors in children and teenagers(0-19years)	No. of cases(n=10)
1.	Pilocytic astrocytoma	2
2.	Pilomyxoid astrocytoma	1
3.	Diffuse astrocytoma	1
4.	Ependymoma	2
5.	Angiomatous meningioma	1
6.	Craniopharynioma	3

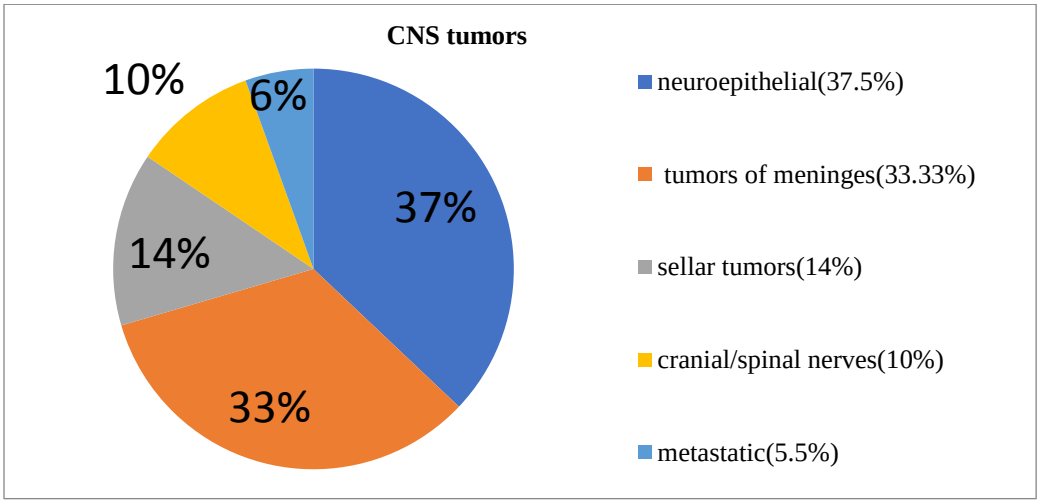
Table 5: Age wise distribution of CNS Tumours

S. No	Age Tumor	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-80	Total
1.	Neuroepithelial	5	1	4	2	4	6	3	2	27
2.	Tumours of Meninges	1			4	6	3	9	1	24
3.	Sellar Tumor		3	1	1	2	2	1		10
4.	Schwannoma				2	4	1			7
5.	Metastasis					2	2			4
	Total	6	4	5	9	18	14	13	3	72

Type of tumours:

Seventy two brain neoplasms were analysed. Neuroepithelial tumours were most common (27cases, 37.5%), followed by Tumours of meninges (24 cases, 33.33%), Tumours of the sellar region (10cases, 13.8%), Tumours of cranial/ paraspinal nerves (7 cases, 9.7%), Metastatic tumours(4cases, 5.5%), Tumours of sellar region predominantly was craniopharyngiomas. Among metastatic tumours adenocarcinoma (3 cases) were most common followed by metastatic follicular carcinoma thyroid (1 case). (Table 5, 2).

Table 6



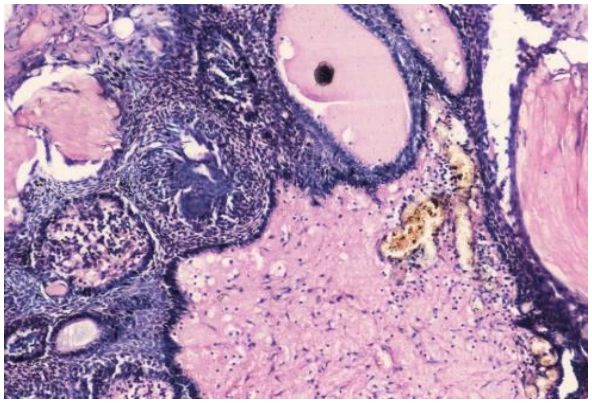


Fig. 1: Craniopharyngioma (H&EX100) -Stellate reticulum

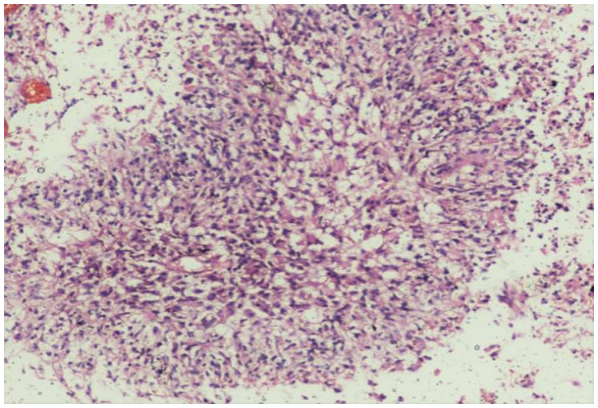


Fig. 2: Glioblastoma Multiforme H&E(X100), with Endothelial Proliferation

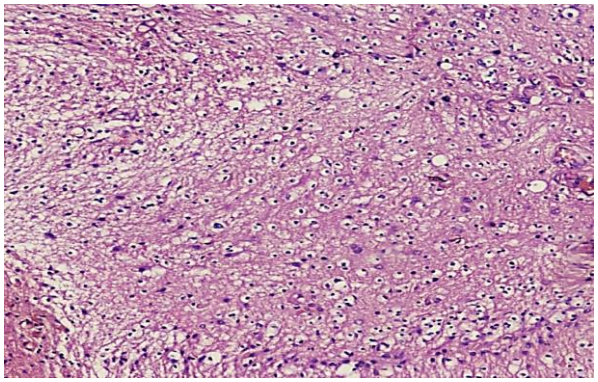


Fig. 3: Pilocytic Astrocytoma X100(H&E)

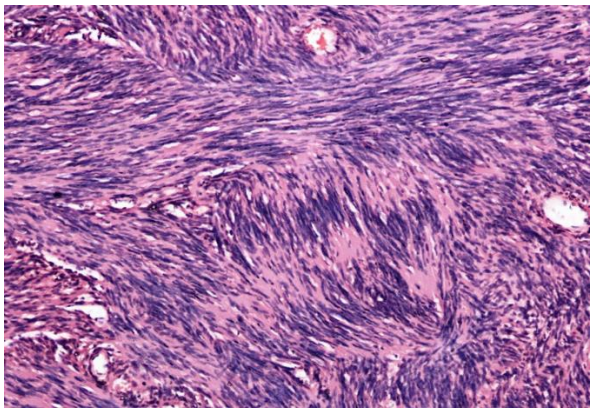


Fig. 4: Schwanomma X100(H&E) with verrocay bodies

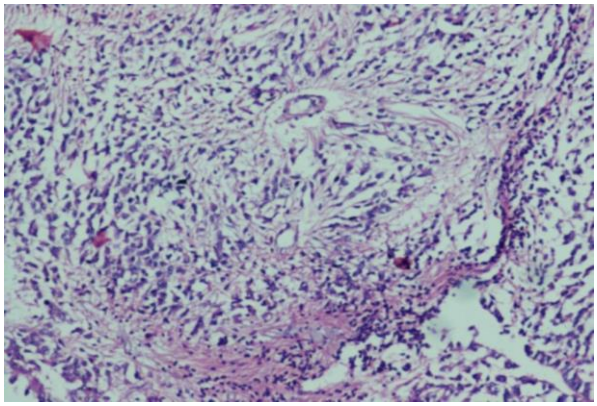


Fig. 5: Ependymoma (H&E X100), Perivascular rosettes

Discussion

CNS is the host of the greatest variety of tumours, so patients with aggressive malignant tumours succumb to the disease in less than one year period. The clinical presentations were headache, seizures, visual disturbances, vomiting's. Headache was the most common presenting symptom encountered in intracranial tumours followed by seizures.

CNS tumours, which account for less than 2% of all malignancies, are associated with guarded prognosis because of their location.[4] In the present study, 72 cases of brain tumours were reported out of a total of 100 neurosurgical specimens received. Microscopic examination of Hematoxylin and Eosin stained sections of routinely processed tissue samples and use of special stains sufficed for a specific diagnosis in majority of cases. However, in cases where morphological variations cause diagnostic dilemmas, IHC was applied to distinguish between different categories of lesions.[5]

Patients age group ranged from 5years to 78years, with mean age of 42.32years. Mean age closely correlated with Tamkeen et al (mean age 43.2years). CTBRUS statistical report, USA, 2005-2009, found mean age to be 59years, which is high compared to present study.[3] Incidence rates for all CNS tumours were slightly higher among males (38 cases) than

females (35 cases). Male to female ratio being 1.08:1. Incidence rates among neuroepithelial tumours were 2.1 times greater in males compared to females, while tumours of meninges were 1.6 times greater in females compared to males.

CTRBUS, Chen et al, Tamkeen et al, Anirban gosh et al found similar findings. In our study, proportion of neuroepithelial tumors and tumors of meninges were 35% and 33% respectively.

This is in concordance with Chen et al study, which revealed proportion to be 38.5% and 36.5%. In contract, CTBRUS stastical study observed this proportion to be 30% and 35.2%. Aryal G, Tamkeen et al found neuroepithelial tumors to be most common which is similar to our study.

WHO grade I were found to be most common which correlated with Aryal G study (Table 3). GBM was the common tumours among astrocytomas (48%).CTBRUS, Chen et al, Aryal G also found GBM to be most common astrocytomas.

Gliomas, the most common of the primary brain tumours in adults, are heterogeneous. Grading of gliomas is done as per the revised WHO criteria.[1] Circumscribed lesions of low proliferative potential are graded as Grade I. Infiltrative tumours are graded as Grade II, whereas infiltrating tumours with increased cellularity and mitotic activity are designated as Grade III. Grade IV is assigned to histologically malignant, mitotically active, and necrosis – prone tumours. Fibrillary astroglial neoplasm were designated as diffuse astrocytoma (WHO Grade II), anaplastic astrocytoma (WHO Grade III), glioblastoma (WHO Grade IV) according to the histologic features.[6,7] One case each of diffuse fibrillary astrocytomas and of anaplastic astrocytoma were diagnosed in our study. Glioblastoma (WHO Grade IV) was diagnosed in 12 cases in the study with the frequency of 16.6% of all the brain tumours and 48% of astrocytic tumours (Table 1). Other workers reported higher frequency of glioblastoma in separate studies.[8,9] Age distribution ranged from third to seventh decades with maximum number of cases in the fourth decade. The diagnosis of glioblastoma was based on tissue pattern characterized by highly anaplastic cells, increased mitotic activity, microvascular proliferation with multi-layering of endothelium and wide areas of necrosis. In our study, accumulation of tumor cells around the neurons and blood vessels was observed. In three cases of glioblastoma, features of diffuse fibrillary astrocytoma of grade II were also seen focally. Primary variant of glioblastoma occurs denovo, while the secondary variant arises within pre-existent, differentiated astrocytic neoplasms.[5] Cellular polymorphism in a heterogeneous glioblastoma can stimulate metastatic carcinoma or melanoma and IHC is necessary for confirmation in such cases.[10,11]

One case of oligodendroglial tumor was reported in the study with a frequency of 0.85%. Histology of a recurrent hemispheric tumor from a 15 year old girl showed a diffusely infiltrating cellular tumor with rounded hyperchromatic nucleus surrounded by a halo and a few cellular processes. Prominent mitotic activity, microvascular proliferation and focal necrosis were present. The presence of a branching capillary network along with microcalcifications was helpful in clinching the diagnosis of anaplastic oligodendroglioma of WHO grade III.[12]

Two cases of ependymal tumours were reported in the present work. A ventricular mass in a 46 year old woman was diagnosed as subependymoma (WHO Grade I), as the histology showed clusters of monomorphic tumor cells around microcystic spaces, rosette pattern, and dense fibrillary matrix. A frontoparietal cystic lesion with a mural nodule in a 4 year old girl was reported as anaplastic ependymoma (WHO Grade III) because of monomorphic cells arranged in perivascular pseudorosettes, mitotic activity, microvascular proliferation and necrosis. In the present study, 7 cases of schwannoma were reported with a frequency of 9.72%. Most of the cases presented as cerebellopontine angle lesions in adults (4 cases). Other sites included brain stem, jugular bulb, acoustic nerve and spinal cord. Schwannoma, the most common variant of nerve sheath tumours in the central neuraxis, occurs in adults in the cerebellopontine angle or lumbosacral spine extramedullary space.[13]

Schwannomas arising at the spinal levels typically involve the posterior roots and assume a dumb bell configuration. In most of the cases, characteristic Antoni A and Antoni B areas, nuclear palisading and vascular hyalinization were sufficient for diagnosing of schwannoma. However, in some cases, IHC is required to differentiate between meningiomas and schwannomas. In contrast to meningothelial tumours, schwannomas show diffuse cytoplasmic S-100 protein expression, but they are negative for EMA.[13,14]

In our study, a dumb bell shaped spinal cord mass at C2-C3 level showed prominent dark pigment and psamommatous calcification on histology. IHC demonstrated positive expression for S-100 and HMB-45 and the tumour was diagnosed as melanotic schwannoma of psamommatous variety. Literature shows that melanotic schwannoma exhibits a predilection for spinal nerve roots.[15,16]

Meningiomas accounted for 24 cases in our study with a frequency of 33.3%. The age incidence varied from second decade to eighth decade with nine cases occurring in the sixth decade. Female preponderance was seen in 14 out of 24 cases. These findings are in accordance with other studies.[17,18,19] In our study, meningiomas mostly presented within cranial cavity and were dura-based. Uncommon sites included sphenoid ridge, cerebellopontine angle and extracranial locations. Arrangement of tumor cells in concentric whorls and presence of clear nuclei with pseudoinclusions and psamomma bodies were the striking histologic features. IHC showed positive expression for EMA and vimentin,

whereas GFAP was negative. All the 16 cases in the study were diagnosed as meningiomas of WHO grade 1, based on these findings. Transitional meningiomas was the common variant followed by Meningothelial, psammomatous and microcystic meningiomas.[20]

In our study, ten cases of craniopharyngioma and six cases of pituitary adenomas were reported with a frequency of 13.8% and 7.8% respectively. Pituitary adenomas constitute 10-15% of all intracranial neoplasms and have prevalence of 1 per 1000 individuals.[21]

Three of ten cases in the study occurred in tenth and twentieth decades, with males outnumbering females in the ratio 4:2. This is in accordance with other studies.[22,23]

Metastatic tumors with secondary involvement of the CNS by direct extension or hematogenous metastasis is a common complication of systemic cancer. In the present study, 4 cases of metastatic tumors were reported with a frequency of 5.5%. Adenocarcinoma was the most common metastatic deposit in our study, found in three cases. There was one case of follicular carcinoma of thyroid metastases to brain.

Brain metastases in adults usually derive from carcinomas of the lung and breast, followed by malignant melanomas, renal carcinomas, and colorectal adenocarcinomas.[26,27] In our study the metastatic lesions were located in cerebral hemispheres, while corpus callosum, cerebellum, and dura accounted for the remaining lesions. These observations are in accordance with literature.[28]

Conclusion

The present study highlights the histological diversity of CNS tumours in various age groups. CNS tumours peak incidence was noted at 4th to 5th decade. Meningiomas and astrocytomas were common tumours after 40 years of age. GBM was the most common among astrocytomas.

Pilocytic astrocytoma, ependymoma, craniopharyngioma were common below 20years of age. WHO grading helps in identifying aggressiveness of tumours, can be used as a component to predict response to therapy and outcome. It can be used as prognostic indicator. IHC was useful in some dilemmatic cases.

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