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Original Research Article

Histomorphological Spectrum of CNS Tumors in a Tertiary Care Centre in Central Tamilnadu

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Abstract:

Objective: the aim of the study is to analyse the histomorphological spectrum of CNS tumors in a tertiary care centre in central tamilnadu using basic H&E staining and limited IHC resource available in our centre.

Materials and Methods: This retrospective histopathological analysis of brain tumors was carried out in the Department of Pathology, Government K.A.P.V Medical College, Thiruchirapalli, Tamilnadu, India, from January 2022 to October 2023. In this study a total of 44 neurosurgical biopsies were retrieved from the archives of the department. The diagnoses in all the cases were made on conventional histopathological examination of the hematoxylin and eosin stained slides and for some of the cases additional IHC markers were used to confirm the diagnosis. Then the tumors were classified according to WHO classification of CNS tumors 2017. The relative frequency of tumors and the distribution as per age, sex, and location of the lesion were analyzed.

Results: A wide range of histopathological spectrum of CNS tumors was observed and was classified according to the recent 2021 WHO classification, 5th edition (WHO CNS5). The primary CNS tumors were graded from Grade I to Grade 1V. Overall Tumors of neuroepithelial cells (40.9%) were the commonest followed by tumors of meninges (34.1%).

Conclusion: The present study helps to provide information regarding the burden of disease in our area. Despite the use of modern imaging technique that helps in provisional diagnosis of disease, histological examination is gold standard in the diagnosis of varied types of brain tumors. Further utility of immunohistochemistry aids in confirmation of sub type.

Introduction

The incidence of CNS tumors ranges from 10 to 17 per 100,000 persons and 1 to 2 per 100,000 persons for intracranial tumors and intra-spinal tumors respectively; Among the CNS neoplasms majority are primary tumors followed by metastatic tumors. [1]

The incidence of brain tumors in India has significantly increased in the past two decades due to the evolution of neuroimaging modalities and is on par with global incidence. [2]

CNS tumors can be diffuse or localized. The clinical manifestations of tumor depending upon the pattern of growth and site of tumor. Some low grade glial tumors can be diffuse and may involve large areas may not be amenable to complete resection resulting in poor prognosis. Irrespective of histological grade or classification a CNS neoplasm can be deadly if it's located in a critical region of brain. [1] WHO CNS5 assigns tumors based on histology, immunohistochemistry and molecular genetics. Over the last 20 years molecular genetics and electron microscopy proved vital in characterizing the biological behaviour of a brain tumor than the conventional histogenesis assessment and immunohistochemistry. [3,4,5]

Brain tumors are predominantly of sporadic lesions; heritable genetic syndromes causing brain tumors are a rare entity. Ionizing radiation exposures, such as computed tomography scans and X-rays, are the only known risk factors accounting for less than 10% of all brain tumors. Recent studies show low frequency non-ionizing electromagnetic wave exposure is associated with gliomas, acoustic neuromas and meningiomas. [4]

Children and elderly individuals are most commonly affected by brain tumors with one peak in children and second peak in 45 to 70 years of age. [6] The tumors are more common in males except of meningiomas which are more frequently seen in females.

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Age	44	10	92	50.32	15.394
Valid N (list wise)	44				

The present study was conducted to analyse the histomorphological pattern of CNS neoplasms in our region and to categorize and grade them according to WHO guidelines.

Materials and Methods

This retrospective histopathological analysis of brain tumors was carried out in the Department of Pathology, Government K.A.P.V Medical College, Trichirapalli, Tamilnadu, India, from January 2022 to October 2023. In this study a total of 44neurosurgicalbiopsies were retrieved from the archives of the department. The diagnosis in all the cases were made on conventional histopathological examination of the hematoxylin and eosin stained slides and for some of the cases additional IHC markers were used to confirm the diagnosis. All the tumors of brain and spinal cord are included in the study. The nonneoplastic conditions of the CNS were excluded.

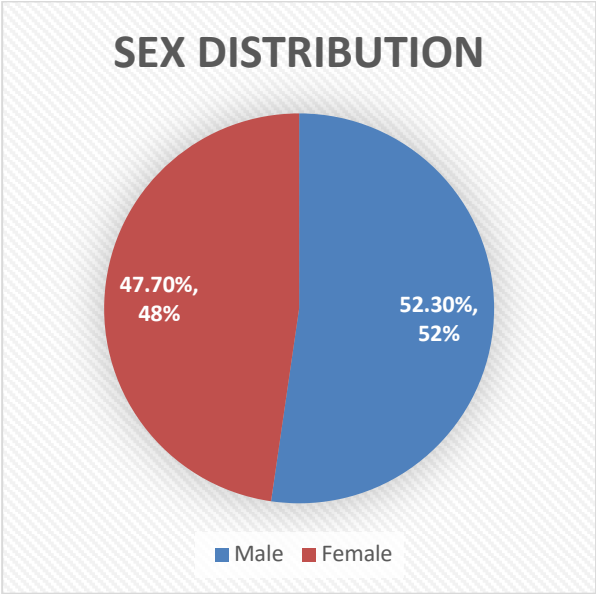

Figure 1:

Table 2: Subtype of Tumors

	Frequency	Percentage
Anaplastic Ependymoma	3	6.8
Diffuse Astrocytoma	5	11.4
Pilocytic Xanthoastrocytoma	2	4.5
Pilocytic Astrocytoma	1	2.3
Glioblastoma Multiforme	5	11.4
Oligodendroglioma	2	45
Meningioma	15	34.1
Schwannoma	4	9.1
Pituitary Adenoma	4	9.1
Metasatic Tumors	3	6.8

Table 3: Laterality of Tumors

Laterality Of Tumor	Number Of Cases
Right	23
Left	19
Midline	2

Table 4: WHO Grade

WHO Grading	Number Of Cases
Grade – 1	17
Grade - 2	9
Grade - 3	10
Grade – 4	8

Result

Out of 44 CNS tumor cases that were diagnosed histopathologically, 23 patients (52.3%) were female and 21 patients (47.7%) were male, thus female to male ratio being 1:0.9 and the most common age group affected were fifth decade followed by sixth decade with a mean age of 50 years(Fig 1).

Tumors of neuroepithelial cells (40.9%) were the commonest followed by tumors of meninges (34.1%); neuroendocrine peripheral nerve sheath tumorsconsituted9.1%; followed by metastatic tumors 6.8 %(►Table 2). The different CNS tumors were classified according to the recent 2021 WHO classification, 5th edition (WHO CNS5) and the primary CNS tumors were graded from I to IV.

According to the data we got from the archives, common symptoms of brain tumors were headache, seizures, visual disturbances, vomiting, gait disturbances, and behavioral problems. The mean age in meningiomas was found to be 55.06 years, and female preponderance was seen with sex ratio of 4:1. Meningothelial meningioma was the most common variant among meningioma followed by transitional variant and psammomatous variant. One case of atypical menigioma was reported.

The tumors of neuroepithelial tissue comprised mainly of diffuse astrocytoma and glioblatoma multiforme (each constitutes 11.4 %) followed by anaplastic ependymoma (6.8%), pilocytic astrocytoma (6.8%) and oligodenroglioma (4.5%) in the descending order of occurrence. In contrast to meningioma, neuroepihelial tumors are more common in males with a sex ratio of 1.42:1 .The next common group of tumors are the schwannomas and pituitary adenomas constituting 9.1 % each. (►Table 2).

We found all the schwannomas pertained to CP angle while pituitary adenomas have a predilection for suprasellar region.

Discussion

In our society the occurrence of CNS tumor is very low among adults but it's the second most common tumor in pediatric age group after hematological malignancies. [6] In adults, the predominant CNS tumor types are glial neoplasms, meningiomas, schwannoma and pituitary adenoma followed by metastatic deposits. In our study we encountered single pediatric tumor, a child with menigothelial menigioma confined to falx cerebri. Recently the difference between adult and pediatric CNS tumors is investigated based on their unique molecular and genetic pathways that determine therapeutic approach for the individual tumor. In this study we had 44 cases of CNS tumors from our centre.

All cases irrespective of age had been categorized according to the recent WHO classification. The male-to-female ratio was 1:0.9, the studies done by Yeole [7] and Ghanghoria et al [8] show meningioma has a female preponderance that correlated with our study. In our study the most common age group affected is 5th decade which correlated with another study done in northern India by Hamdani et al. [9]

In our study Tumors of neuroepithelial cells (40.9%) were the commonest followed by tumors of meninges (34.1%), neuroendocrine & peripheral nerve sheath tumors constituted 9.1% in the descending order. In the studies done by Patty [10] and Das et al. [11] reported tumors of neuroepithelial tissue are common in their studies similar to our study. The tumor distribution and relative frequency are influenced by various genetic and environmental factors.

Tumor of Neuroepithelial Tissue

In the present study, the most common neuroepithelial tumors are is WHO grade-II diffuse astrocytoma followed by WHO grade-IV glioblastoma with male preponderance which well correlated with other studies.

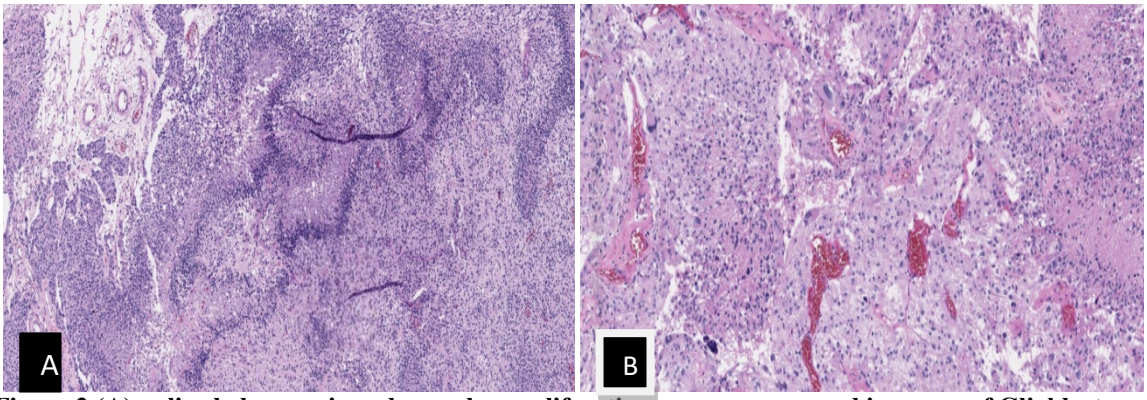

Figure 2 (A) palisaded necrosis and vascular proliferation more pronounced in a case of Glioblastoma (H&E; 10) (B) Glioblastoma showing Increased cellularity and mitoses in (H&E; 10). H&E, hematoxylin and eosin.

Microscopically, diffuse astrocytomasis a mixture of cells with elongated nuclei and fine fibrillar processes, cells with eccentric nuclei and glassy eosinophilic cytoplasm, larger pleomorphic cells and small cells with scant cytoplasm and with variable pleomorphism. The glioblastoma was characterized by infiltrating, hypercellular astrocytic neoplasm often with hyperchromatic, elongated nuclei and irregular nuclear membranes with brisk mitosis (Fig. 2 (A). There are areas of pallisadingnecrosis, vascular proliferation and high cellularity. (Fig. 2A & B). Glioblatoma has a male preponderance with all the reported cases were males where as in diffuse astrocytoma it has a female preponderance which very well correlated with other studies. The lowest age of occurrence of glioblastoma and diffuse astrocytoma were 45 years and 25years respectively.

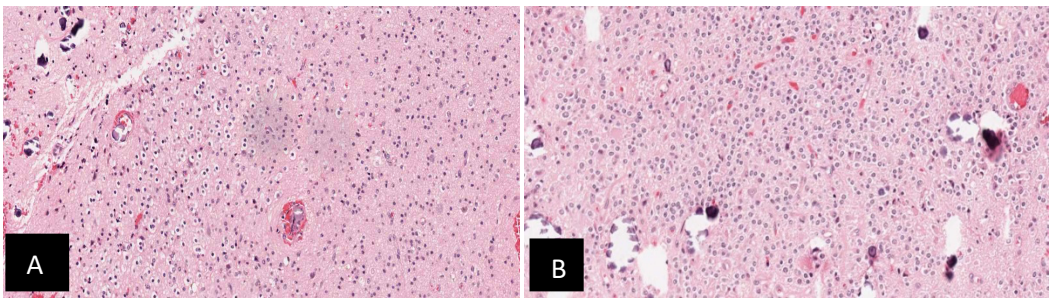

Figure 3: (A&B) Anaplastic oligodenroglioma showing monotonous population glial cells high cellularity, nuclear anaplasia and detectable mitotic activity (H&E; 10).

In our study we reported 2 cases of Oligodendroglioma of which one is an anaplastic type with WHO grade III. Tumor composed of oligodendrocytes with round nuclei, cleared cytoplasm forming “halos” and has typical chicken wire thin-walled capillaries (Fig 3 A). Anaplastic oligodendroglioma (WHO grade III) was characterized by a higher cell density, nuclear anaplasia, detectable mitotic activity, and necrosis (FIG 3B).

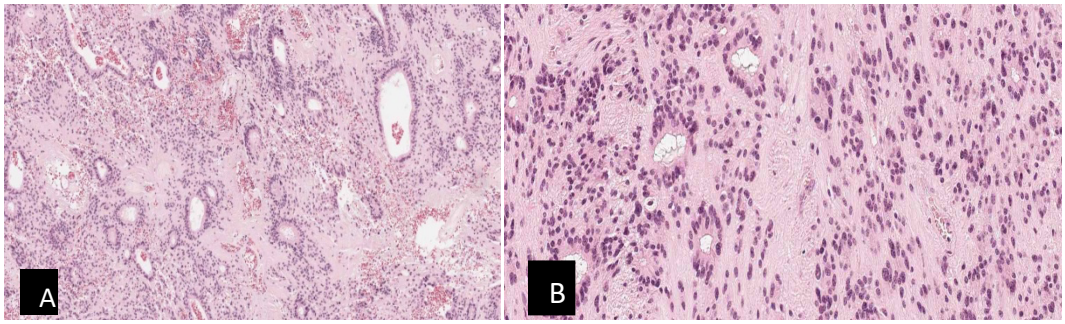

Figure 4: (A) highly cellular diffuse tumor with Fibrillary perivascular pseudorosettes and few scattered true rossetes Fig. 4(B).

In this study we reported 3 cases of anaplastic ependymoma of who grade III. Ependymoma composed of cellular tumor with typical sharply infiltrative borders, monomorphic round to oval cells with speckled chromatin along with perivascular pseudorosettesand true ependymal rosettes (Fig. 4 A & B).

Tumors of the Meninges

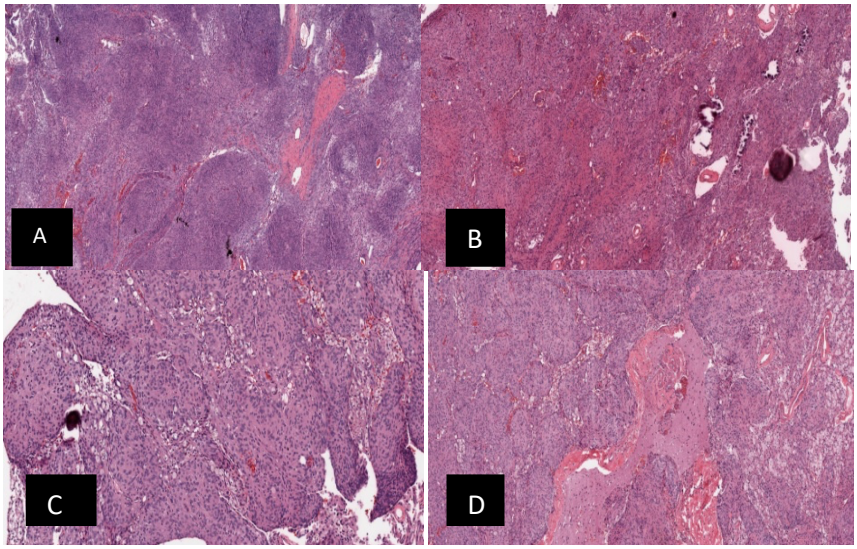

Figure 4: (A) Classical whorls of Meningothelial meningioma (H&E; 10) (B) papillary architecture in papillary meningioma (H&E; 10) (C) scattered Psammoma bodies in psammomatousmeningioma (H&E; 10). (D) Necrosis and hyper cellularity in atypical meningioma(H&E; 10). H&E, hematoxylin and eosin.

In our study meningothelial meningioma (WHO grade I) is the commonest subtype and the commonest location of meningioma in brain was meninges of frontal region followed by falx cerebri.

We observed formation of whorlsby spindle cells which are typically witnessed in meningothelial variant (Fig. 4A) & we found numerous psammoma bodies in psammomatous variety (►Fig. B&C).we reported a case of atypical meningioma (WHO grade III) located in the skull base. Histopathological features of atypical meningioma in this case were necrosis, pattern less growth at places, and increased cellularity (►Fig. 4D). Another case of Transitional meningioma (WHO grade I) located in falxcerebri was reported. The histopathological features were mixture of meningothelial and fibroblastic features along with usual whorls psammoma bodies and clusters of syncytial cells.

Tumors of Cranial and Paraspinal Nerves

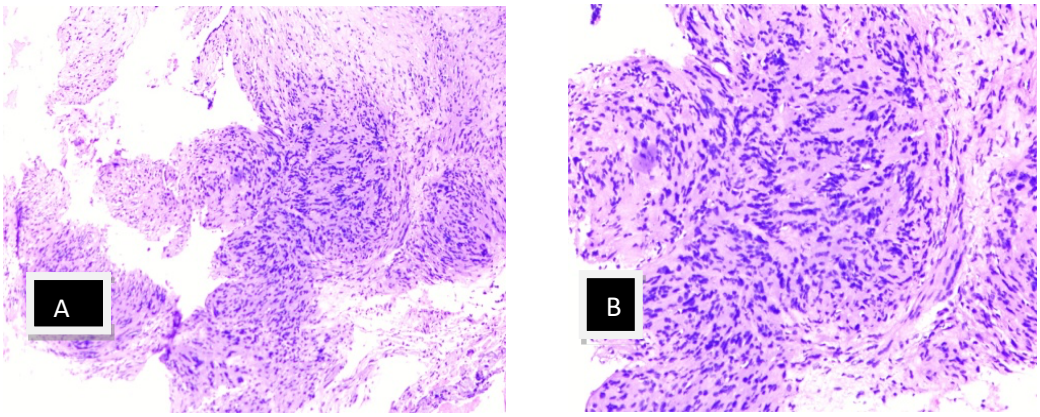

Figure 5: (A&B) showing Antony A and Antony B areas with verrocay bodies.

We reported 4 cases of schwannoma were located at thecerebello pontine angle with typical histopathological features composed of antoni's A&B Areas with verrocay bodies. (Fig. 5 A&B).We reported 4 cases of Pituitary neuroendocrine tumor pertaining to suprasellar region. Most tumors have a uniform nuclear morphology with stippled chromatin, inconspicuous nucleoli and moderately abundant cytoplasm (Fig).

In our study we found 3 cases of metastatic deposits of which two were from adenocarcinoma and one turned out to be a squamous cell carcinoma.

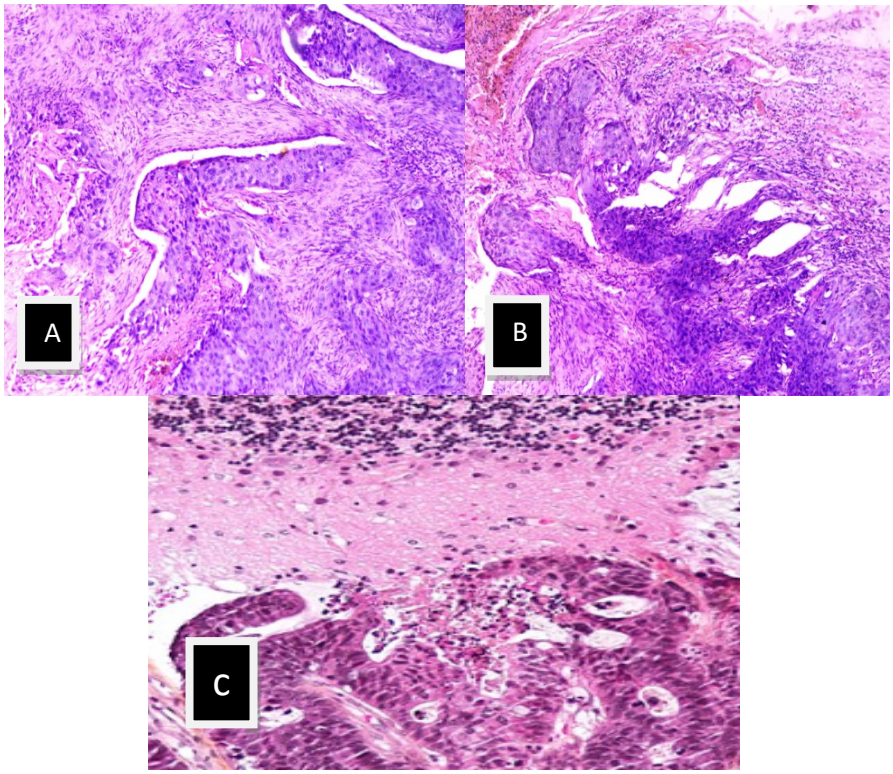

Figure 6: A&B metastatic carcinomatous deposit from squamous cell carcinoma; c –adenocarcinoma from the lung primary.

Our study we reported all the cases using basic H&E staining and limited use of IHC panel composed of GFAP, EMA, Vimentin, S100, CD56, HMB 45 and KI 67 diagnosing certain tumors.

Conclusion

Tumors of the CNS have varied clinical and histopathological characteristics. Globally there is an increased trend in the incidence of CNS tumors.

Conventional histopathology coupled with IHC still hold the key in the diagnosis of CNS neoplasms.

This study conducted in a small government centre with limited resources. Large scale detailed studies across the state incorporating IHC and molecular genetics will enable us for better understanding of etiopathogenesis and epidemiology of CNS tumors in our region.

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