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A Five Year Retrospective Study of Central Nervous System Tumors

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ABSTRACT

Background: The aim of this study was to evaluate the incidence of histopathology proven tumors of the central nervous system (CNS) from a referral tertiary health care system in Tamil Nadu over a period of five years and correlating with clinical parameters such as age, sex and site and comparing them with other similar studies done outsid.

Methods: In the period of five years we analysed retrospectively data on 180 patients diagnosed with CNS tumors according to the WHO diagnostic criteria. Patients data were retrieved from the archives of the department of pathology.

Results: A total of 180 cases of CNS tumors were diagnosed during a five year periods, of these 177 cases were primary and 3 were metastatic. The most frequent type of CNS tumor was meningioma (61 cases, 33.88%) followed by astrocytoma (46 cases, 25.56%) of which grade IV tumor was high (34.78%) and schwannoma (22 cases, 12.72%). Primary CNS tumors showed peak incidence in the fourth to fifth decade and in metastasis it was in sixth to seventh decade. The most common site of occurrence was frontal lobe followed by parietal lobe.

Conclusion: The most common tumor in this study was meningioma followed by astrocytoma and schwannoma with peak incidence in the fourth to fifth decade of life. The ratio of male to female in the overall evaluation of CNS tumors was 1.4:1 except in meningioma where the male to female preponderance was of 1:2.3. The most common site was frontal lobe followed by parietal lobe.

Keywords: Astrocytoma, meningioma, metastatic, primary, tumors

INTRODUCTION

Neoplasms of the CNS can occur in both adults and pediatric populations. Although adult and children may experience similar tumors, their incidences vary greatly with age. Among adults glioblastomas, meningiomas and metastasis to CNS are the most common neoplasms, whereas in the pediatric age group pilocytic astrocytomas, medulloblastomas and ependymoma are far more common.[1] The glial tumors include astrocytoma, ependymoma, oligodentroglioma and various subtypes. It is important to identify oligodentroglial component in order to determine the most effective chemotherapy to use for these gliomas.[2] Non glial tumors includes embryonal tumors, choroid plexus tumors, pineal tumors, meningeal tumors, germ cell tumors, tumors of the sellar region and hematopoietic tumors. The correct histological diagnosis of CNS tumors is essential to

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predict the prognosis. In this study the incidence, age, sex and site of CNS tumors, including tumors of the cranial and peripheral nerves have been determined by analyzing 180 cases according to WHO classification and grading.

MATERIALS AND METHODS

A total of 180 cases of CNS tumors were retrieved from the archives of the department of pathology. All primary and metastatic tumors presenting with neurological symptoms were taken for this study. Non neoplastic lesions presenting with neurological symptoms and tumors diagnosed on the basis of neuroimaging studies without histological confirmation were excluded from this study. All the surgical specimens received in the Department of Pathology were fixed in 10% neutral buffered formalin. Most of the biopsies were small biopsies which were completely processed, embedded and sectioned. Only few of them were relatively big and required sectioning from representative areas. Sections were processed as small sections of 2-3 mm in thickness in the automatic tissue processor and processed in a routine way. Sections of 5µ thickness were cut and stained with Hematoxylin and Eosin, and in controversial cases slides were submitted for immunohistochemistry to substantiate the diagnosis. Histological classifications of these tumors were done as per WHO classification and they were graded as per WHO. The incidence of the tumors over a five year period and the distribution based on age, sex and location were analysed.

RESULT

A total of 180 cases of CNS tumors were diagnosed during a five year period of these 177 cases (98.33%) were primary and 3 (1.67%) were metastatic tumors. The most frequent type of CNS tumor was meningioma (61 cases, 33.88%) followed by astrocytoma (46 cases, 25.56%), schwannoma (22 cases, 12.72%) ependymoma (10 cases, 5.56%), pituitary adenoma (Figure 1) (9 cases, 5%) and oligodentroglioma (5 cases, 2.78%) (Table 1).

Tumors of Neuroepithelial Tissue

Among the 68 tumors of the neuroepithelial tissue the astrocytic tumors (Figure 2) were most common histologic type (46 cases, 25.56%) followed by ependymoma (10 cases, 5.56%), oligodentroglial tumors (9 cases, 5%), medulloblastoma (5 cases, 2.78%) mixed neuronal glial tumors (3 cases, 1.67%) (Figure 3) and pineocytoma (1 case, 0.56%). The most common type of astrocytoma was WHO grade IV (34.78%) followed by grade II (32.6%), grade I (21.74%) and grade III (10.87%) (Table 2).

Tumors of Non Glial Tissue

The most common tumor of non glial tissue was meningioma (61 cases, 33.88%), of which WHO grade I meningioma was 57 cases (31.67%), grade II meningioma 3 cases (1.67%) and grade III meningioma was 1 case (0.56%).The nerve sheath tumor consists of schwannoma 22 cases (12.78%) and malignant peripheral nerve sheath tumor was 1 case (0.56%). Tumors of sellar origin consist of pituitary adenoma 9 cases (5%) and craniopharingoma 4 cases (2.22%). Mesenchymal tumors were hemangioma 2 cases (1.11%) and hemangiblastoma 3 cases (1.67%) (Figure 4). Metastatic tumors were 3 cases constitute about 1.67% of all CNS tumors.

Age, Sex and Site Distribution

The age range for CNS tumors in our study was 1 to 79 years with peak incidence in the primary tumors was fourth to fifth decade and in metastasis it was sixth to seventh decade (Table 3). Among the 180 cases of CNS tumors 96 cases were males and 84 were females with the male to female sex ratio was 1.4:1 except in meningioma male to female ratio was 1:2.3 (Table 4). The

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most common site for CNS tumors was frontal lobe followed by parietal lobe (Table 4). Astrocytoma was most common in frontal lobe followed by parietal lobe, ependymal tumors in the spinal cord, meningioma in the dura, schwannoma in the cerebellopontine angle, pituitary adenoma in the sellar region and medulloblastoma in the cerebellum.

CNS tumors in children

In our study, tumors in children were in the age group of 1 to 16 years composed of 11.67% of all CNS tumors. The peak incidence was in the first decade with male to female ratio of 1.75:1. Medulloblastoma was the most common tumor followed by pilocytic astrocytoma and craniopharingioma. The most common site was cerebellum and sellar region.

Table 1 Showed the Distribution of CNS Tumors

Histological type	No of cases	% of total cases
Neuuroepithelial tumors	69	41.69%
Tumors of meninges	61	33.88%
Tumors of cranial nerves	23	12.78%
Tumors of sellar region	13	7.22%
Mesenchymal tumor	5	2.78%
Embryonal tumor	6	3.34%
Metastatic tumors	3	1.67%
Total	180	100%

Table 2 Showed Distribution of Astrocytoma According to WHO Grading

WHO Grading	No of Cases	% of Total Cases
Grade I	10	21.74%
Grade II	15	32.6%
Grade III	5	10.87%
Grade IV	16	34.78%
Total	46	100%

Table 3: Frequency of Age Distribution of CNS Tumors

Age group in years	Males	Females	Total	% of total
1 – 10	9	4	13	7.22%
11 – 20	13	7	20	11.11%
21 – 30	8	7	15	8.33%
31 – 40	17	18	35	19.44%
41 – 50	18	25	43	23.89%
51 – 60	16	20	36	20%
61 – 70	14	3	17	9.44%
71 – 80	-	1	1	0.56%
Total	95	85	180	100%

Table 4: Frequency of Sex Distribution of CNS Tumors

HISTOLOGICAL SUBTYPE	MALE TO FEMALE RATIO
NEUROEPITHELIAL TUMORS Astrocytoma	 1.7:1

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Ependymoma Oligodentroglioma Mixed neuronoglial tumors	10:1 1.25:1 1:1.5
Meningioma	1:2.3
Schwannoma	1.3:1
Sellar tumors	1.25:1
Medulloblastoma	4:1
Mesenchymal tumors	5:1
Metastatic tumors	1:2
TOTAL	1.4:1

Table 5: Frequency of Site Distribution of Primary CNS Malignancies

Tumor location	No of cases	Percentage of cases (%)
Frontal	51	28.33%
Parietal	26	14.44%
Temporal	11	6.11%
Occipital	1	0.56%
Ventricles	5	2.78%
Cerebellum	9	5%
Brain stem	2	1.11%
CP angle	14	7.78%
Spinal cord	22	12.22%
Sellar	12	6.67%
Supra sellar	1	0.56%
Meninges	18	10%
Brain NOS	8	4.44%
Total	180	100%

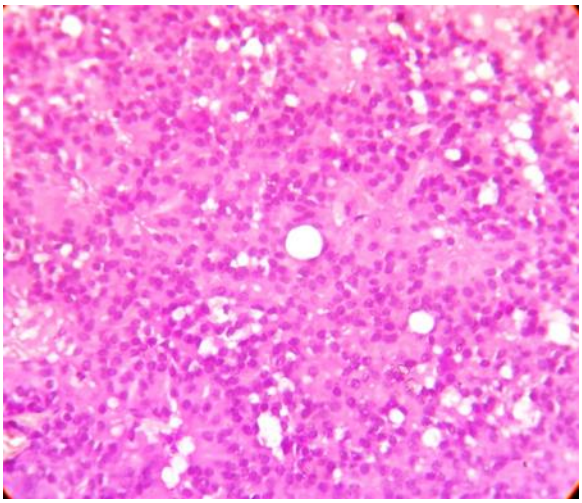

Figure 1 Pituitary adenoma shows chromophobic cytoplasm, central nuclei with delicate chromatin

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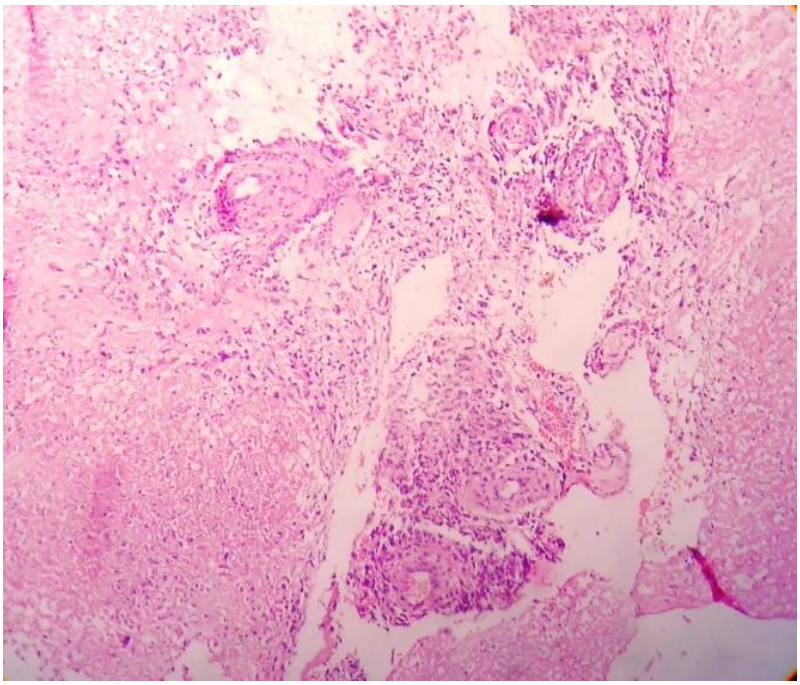

Figure 2 Glioblastoma shows bizarre nuclei, endothelial proliferation and necrosis

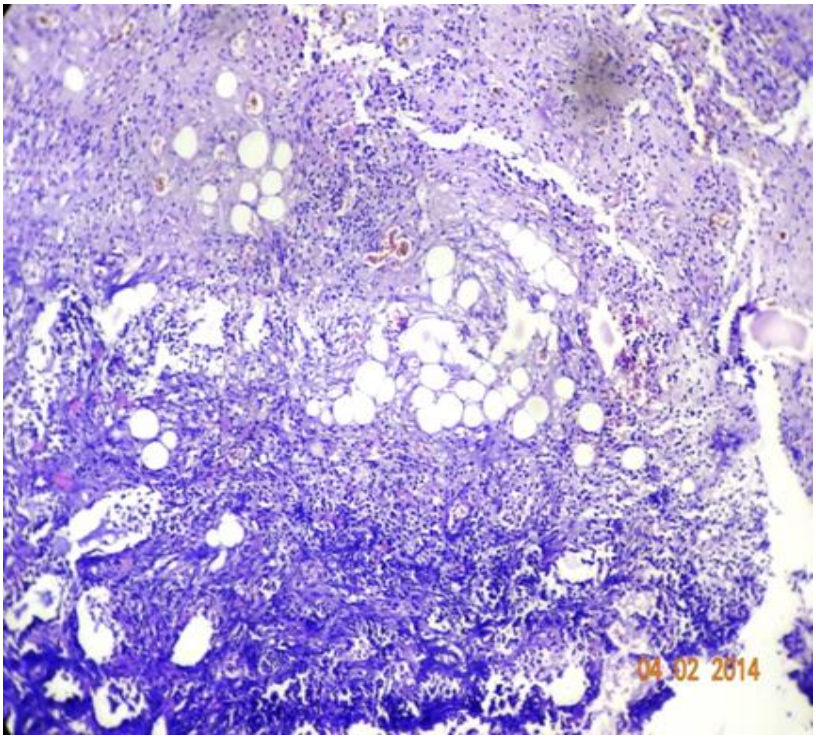

Figure 3 Dysembryoblastic neuroepithelial tumor shows spindled cells, small round cells admixed with adipocytes

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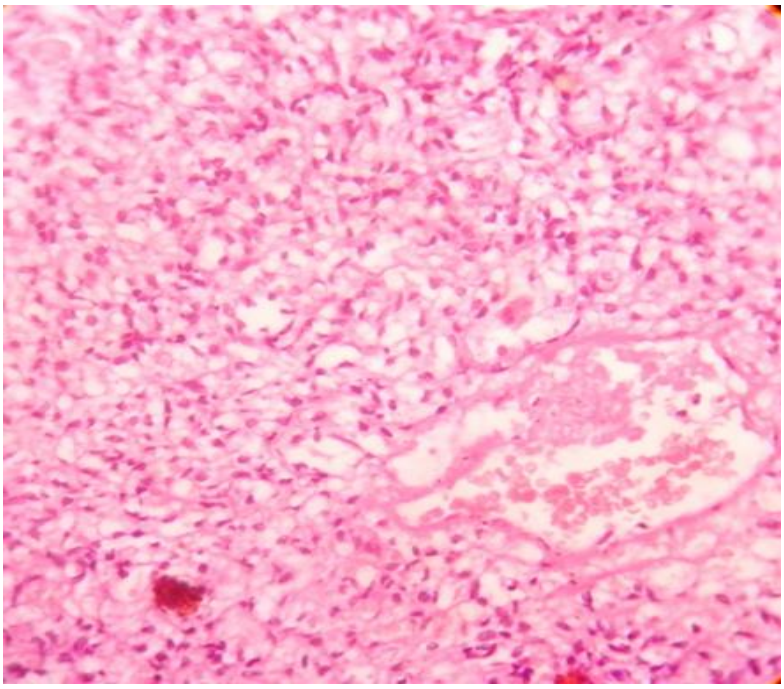

Figure 4 Hemangioblastoma shows clusters of stromal cells separated by vascular channels

DISCUSSION

In the present study the most common tumor was meningioma with an incidence of 33.88% of the total neoplasms followed by astrocytoma constitutes about 25.56%, and schwannoma of 12.78%. There have been several important reviews on CNS tumors regarding the incidence and relative percentages of these neoplasms in the United States, Europe and Asia. In contrast to our study the most common primary tumor was astrocytoma in United States, Nepal, Taiwan, Mexico and Germany[3-7]. Our study correlates with Korea[8] and Singapore[9] where meningioma (35%) was the most common tumor followed by astrocytoma (18.5%). Meningioma was the most common tumor followed by neuroepithelial tumor, schwannoma and pituitary tumor among atomic bomb survivors in Hiroshima and Nagasaki, Japan as seen in our study[10]. The difference in the relative frequency and the tumor distribution among populations in different countries may be due to genetic and environmental factors.

Histological grading is a means of predicting the biological behavior of neoplasm. The grading factors influence the choice of therapy. The most common type of astrocytoma in our study was WHO grade IV type (34.78%) followed by grade II (32.6%) as seen in the literature[4]. The late presentation of our patients to the hospital could be the possible cause.

In our study incidence of primary CNS tumors increases with age with a peak incidence in fourth to fifth decade and in metastasis it was sixth to seventh decade[11]. CNS tumors showed male preponderance with male to female ratio of 1.4:1[12-16]. However the sex ratio varies considerably by histological type. Gliomas are higher in males with a male to female ratio 1.7:1 and meningiomas are higher in females with a male to female ratio of 1:2.3[9]. A report from USA[17], meningiomas were the only tumors with female preponderance as seen in our study. Metastatic tumors were most common in sixth to seventh decade as seen in Korea[18].

In the present study frontal lobe was the most common site of involvement with an incidence of 28.33% followed by parietal lobe in 14.44%, spinal cord in 12.22% and meninges in 10% of cases as seen in Yasmin Bhurgri et al[19].

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Brain tumors are the second most common cause in children comprising 15 to 25% of all peadiatric malignancies and they are the most common solid tumor. Different proportion of histological subtypes are present in children compared to adults with gliomas 10% and medulloblastomas 5% mainly arising infratentorially with the craniopharingioma occurring in the midline. Higher proportions of medulloblastomas and craniopharingiomas were found in children and teen agers in our series, which seems to be in accordance with the reports from Taiwan, France, India and Brazil[20-23]. The incidence of brain tumor is higher in male children compared to female children as seen in the literature[24-25].

CONCLUSION

A total of 180 cases of CNS tumors were diagnosed during a five year periods of these 177 cases (98.33%) were primary and 3 (1.67%) were metastatic. The most frequent type of CNS tumor was meningioma (61 cases, 33.88%) followed by astrocytoma (46 cases, 25.56%) of which grade IV tumor was high (34.78%) and schwannoma (22 cases, 12.72%). Primary CNS tumors showed peak incidence in the fourth to fifth decade and in metastasis it was in sixth to seventh decade. The ratio of male to female in the overall evaluation of CNS tumors was 1.4:1 except in meningioma where the male to female preponderance was of 1:2.3. The most common site of occurrence was frontal lobe followed by parietal lobe.

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