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A Histopathological Study of Central Nervous System Primary Neoplasms

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***Abstract**: Background: Central Nervous System(CNS) neoplasms are unique in histomorphology and also have high influence on the patient as space occupying lesions due to their location in vital organs. Both the benign and malignant tumors together form a wide spectrum. The study of the CNS primary tumors is helpful to know the frequency and thereby the problem load on the society, biological behaviour of the tumors and prognosis of various tumors.*
Aim: to study the spectrum of the CNS primary tumors and to correlate with the clinical and radiological findings. To correlate with the other similar studies.
Materials and Methods: study design – Prospective, Observational and Cross section study.
Study period – four years duration (July 2015 to June 2019)
Inclusion criteria – all the CNS primary tumors reported in Royal Diagnostics & Research Center, Vijayawada, Andhra Pradesh.
Exclusion criteria – tumors reported before and after the study period, recurrent cases, metastatic deposits, all the neoplasms from other than CNS origin and all the non neoplastic lesions of the CNS.
Results: in this study, 68 of CNS tumors were studied out of which commonest tumors were Astrocytomas with 19 in number (27.94%). Male preponderance was observed in general, except in meningiomas. The range of the age varied from 11yrs to 80 yrs. The commonest site involved was cerebrum.
Conclusion: The present study revealed the common type of CNS primary tumors, their biological behaviour which is useful in prognosis and management, mean age affected, male to female ratio and the other important features. As it was correlated with other similar studies, it gave the local intensity of the problem in the study area and helped to compare with the other areas.
***Key words**: Primary neoplasms, glioblastoma, meningioma, Immunohistochemistry, biological behaviour, medulloblastoma, pheochromocytoma and pituitary adenoma.*

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I. Introduction

The central nervous system consists of intracranially located brain, with attached spinal cord. Other structures like pituitary, pineal gland and cranial nerves are also present in the brain tissue. The brain is further divided into Cerebrum with two (right & left) hemispheres, posteriorly placed Cerebellum with two hemispheres connected by the Vermis in the median portion, brain stem which connects the spinal cord. Ventricular system with four ventricles and meninges which are the three membranes covering brain and the spinal cord.

Ionizing radiation, congenital and certain genetic disorders are the major known risk factors for primary CNS tumors[1]. Limited evidence is available with smoking, alcohol, maternal diet during pregnancy, and tobacco etc. First CNS tumor classification was by Virchow with the introduction of the term ' Glioma' in 1863. Recent classification is four tier WHO 2007 classification with consideration of features like cellularity, atypia, mitosis, atypical mitosis, stromal/vascular proliferation and necrosis[2].

According to WHO 2007 classification, major categories of CNS tumors are Astrocytic tumors, oligodendroglial tumors, oligoastrocytic tumors, ependymal tumors, choroid plexus tumors, other neuroepithelial tumors, pineal tumors, embryonal tumors, tumors of cranial and spinal nerves, tumors of the meninges, lymphomas, haematopoietic, germ cell tumors, sellar region tumors and metastatic deposits[3].

II. Materials and Methods

Present study of primary CNS tumors was done by Dr. P.Annapurna, Associate Professor of Pathology, Siddhartha Medical College, Vijayawada (consultant Pathologist in Royal diagnostics and Research centre) and

Dr. Vajrala Sivakumar, neurosurgeon, Vajrala Raja Linga Sastri Neuro Hospital, Vijayawada with the guidance of Dr. R. Sasank, Professor of Pathology, Principal, Siddhartha Medical College, Vijayawada and Academic DME of Andhra Pradesh.

Study period: four years (July 2015 to June 2019)

Study design: Prospective, Cross sectional and observational

Study centre: Royal diagnostics & Research center, Vijayawada.

Study material: all CNS primary tumors reported among the received specimens during the study period in Royal Diagnostics & Research Center, Vijayawada.

Inclusion criteria: all the biopsies which were diagnosed as primary CNS tumors during study period in Royal Diagnostics & Research Center, Vijayawada.

Exclusion criteria: Tumors from the sites other than CNS, non neoplastic lesions of CNS and the primary CNS tumors received before and after study period.

Methodology: We receive a good number of biopsies of which CNS tumors are from local neurosurgeons. In the study period of four years, the center received total number of 2886 biopsies and CNS tumors were 68 in number with 2.36%. Along with the specimen, operative findings, radiological and clinical details were collected. The specimens were measured, weighed at the time of grossing and after recording the external and cut section findings, bits were given from representative areas. In small biopsies total material was processed. Sections were processed stepwise and embedded in paraffin. Haematoxylin and Eosine staining was done for all cases. Special stains & Immunohistochemistry were done wherever needed, particularly in gray zone diagnoses.

III. Results

During the study period of four years, total number of 2886 specimens were received for histopathological examination. Out of these 2886 specimens received, 68 were diagnosed as primary CNS tumors, contributing 2.36% of total received specimens in Royal diagnostic & Research center, Vijayawada. In this prospective study of 68 primary CNS tumors, the common complaint from the patients was headache[4]. Maximum affected site was cerebrum and within cerebrum, frontal lobe was the more affected area. Common histological type of tumor was glioma. The range of the age varied from 11yrs to 80 yrs. In general, CNS tumors showed male preponderance except in meningiomas, which were seen more in female patients. Different parameters like age, sex, site, histological variants, and biological behaviour were studied. Simple statistical tools were applied when data was analysed. Data was presented in tables and charts. Some of the microscopic pictures were also included.

Coming to age distribution, youngest case was of 11yrs boy with medulloblastoma and the oldest case was of 80yrs female patient having Schwannoma. Age wise distribution of the cases was shown in table 1.

Table 1. Age wise distribution of primary CNS tumors

Sl No.	Age in yrs	No. of cases	Percentage
1	11 – 20	04	05.89
2	21 – 30	09	13.24
3	31 – 40	10	14.70
4	41 – 50	19	27.94
5	51 – 60	15	22.06
6	61 – 70	08	11.76
7	71 – 80	03	04.41
	Total	68	100

Highest frequency of the tumors were seen the age group of 41 to 60 yrs contributing 50% of the tumors and the minimum number of cases were presented in the age group of 71 to 80 yrs age group. None of the cases were reported below 11yrs and above 80 yrs aged patients.

In the gender study of the cases it was observed that of 68 cases, 38 were males and remaining 30 were females. This was shown in table 2.

Table 2. Gender wise distribution of primary CNS tumors

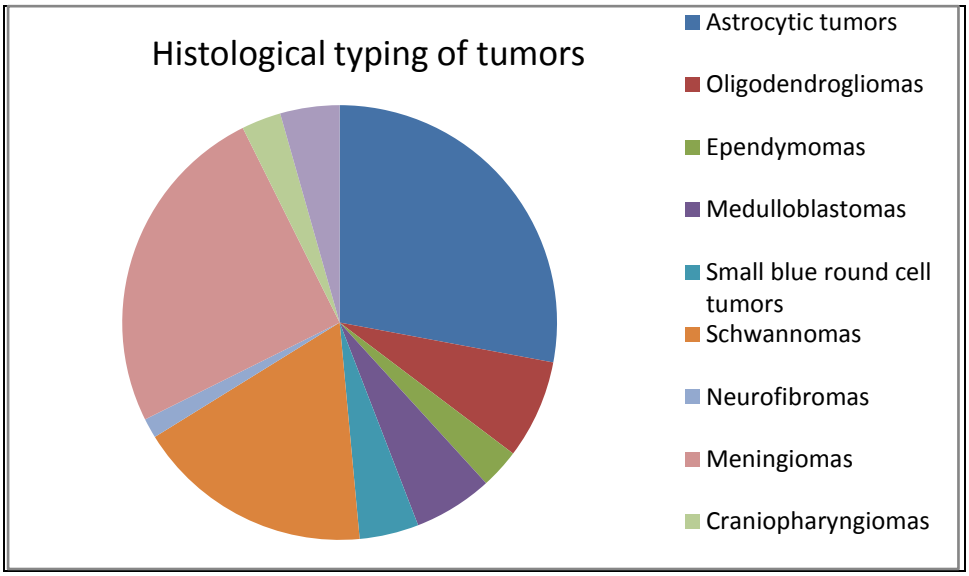
Sl No.	Gender distribution	No. of cases	Percentage
1	Male cases	38	55.88
2	Female cases	30	44.12
	Total	68	100

In the present study, male to female ratio was 1.27: 1, which was well correlated with other similar studies. When the tumors were studied according to 2007 WHO classification, all types of tumors showed male preponderance except meningiomas, where female ratio was observed more.

The histological typing of the tumors, according to WHO classification 2007, which was the main parameter of the study was represented in table 3. This table showed that meningiomas were the common type of primary CNS tumors, next to gliomas.

Table 3. Histological typing of primary CNS tumors

Sl No.	Histological type of tumor	No. of cases	Percentage
1	Astrocytic tumors	19	27.94
2	Oligodendrogliomas	05	07.36
3	Ependymomas	02	02.94
4	Medulloblastomas	04	05.88
5	Small blue round cell tumors	03	04.41
6	Schwannomas	12	17.65
7	Neurofibromas	01	01.47
8	Meningiomas	17	25.00
9	Craniopharyngiomas	02	02.94
10	Pituitary tumors	03	04.41
	Total	68	100



IV. Discussion

Primary tumors of Central nervous system are of huge variety, with a contribution of less than 2% of all neoplasms[5,6]. In this study highest number of tumors were Astrocytomas of different grades. Total Astrocytomas were 19 (27.94%) of which, low grade Astrocytomas were 06, high grade tumors were 08 and Glioblastomas were 05 in number. Microscopy showed mild pleomorphism in low grade tumors, severe pleomorphism and increased mitotics in high grade tumors and in Glioblastomas, tumor giant cells with increased vascularity along with necrosis were seen. Males were more affected slightly than females. Peak incidence was observed in 50s of the age.

Next common variety of tumors observed in the present study were Meningiomas, where females were more affected in contrast to Astrocytomas. Seventeen (25%) meningioma cases were reported in the present study. Various histological variants of meningiomas like meningotheliomatous, fibroblastic, transitional, psammomatous and angiomatous types were reported. Common ones were transitional (9) and meningotheliomatous (3) types.

Oligodendrogliomas were the another group of tumors with five cases with a share of 7.36% of total cases. Frontal lobe of the cerebrum was the commonly involved area. Round nuclei with clear perinuclear halos were present in microscopic picture.

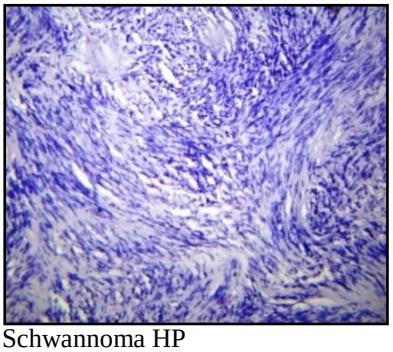
Other tumors from neuro epithelial tissues reported in the study were two cases of ependymomas.

Another major variety of tumors diagnosed in the present study were Schwannomas with twelve cases comprising 17.65% of total tumors, mostly presented as cerebellopontine tumors with characteristic features like hyper and hypo cellular areas with nuclear peripheral palisading of benign spindle cells. Antoni A and B areas and Verocay bodies were the diagnostic features.

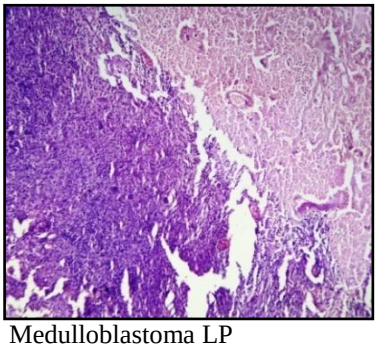
In addition to Schwannomas, one case of neurofibroma was included in the present study in the category of tumors from nerve sheath of craniospinal axis.

Younger age group of patients were presented with Medulloblastomas which is common in pediatric age group. In the present study four cases (5.88%) were diagnosed as Medulloblastomas, and all four were seen in second decade of the age with minimum of 11yrs old. Common site affected was cerebellar vermis. Microscopic picture showed high cellularity and cells with hyperchomatic nuclei and scanty cytoplasm.

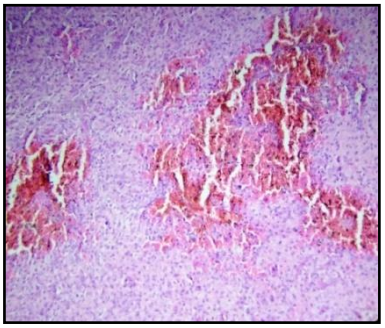
The other similar type of the tumors reported in the present study were three cases of Small blue round cell tumors which include one lymphoma out of total 68 cases (4.41%).



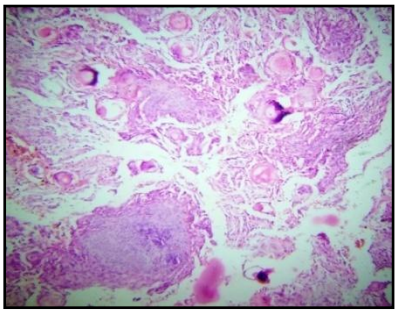
Schwannoma HP



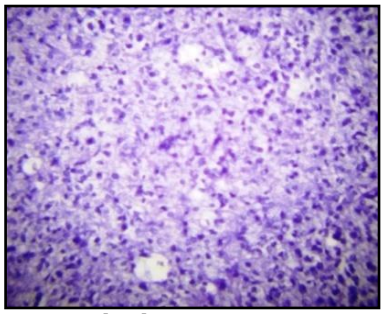
Medulloblastoma LP



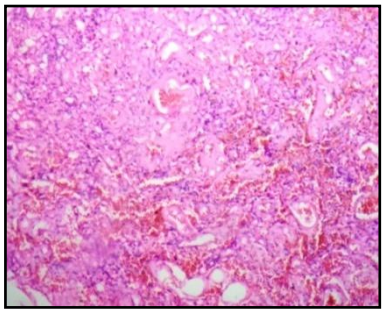
Glioblastoma HP



Psammomatous Meningioma HP



Low grade glioma HP



Angiomatous Meningioma LP

Two cases of Craniopharyngiomas (2.94%) and three cases of Pituitary adenomas (4.41%) were diagnosed representing the tumors from the sellar region. Pituitary adenomas were seen in the age around 50yrs and Craniopharyngiomas were reported in little bit younger age group.

The present study results were compared with other similar studies and well correlated with the study by Surawicz et al and the study by Ghanghoria et al[7,8].

Once provisional diagnosis is made based on clinical features, the radiological findings are useful in diagnosing. Like any other tumors, histopathological examination is the confirmation test in diagnosing CNS tumors. In this study, special stains like reticulin and IHC were used to confirm Medulloblastomas.

V. Conclusions

Primary CNS neoplasms have many overlapping histomorphological features. Some of the non neoplastic lesions also mimic CNS tumors. As the CNS tumors have different biological behaviours, wide range of prognosis and multiple lines of management, accurate diagnosis is essential. In spite of advanced radiological techniques, histopathological examination is still having a lead role as gold standard in diagnosis.

Histopathological study of the CNS tumors is useful to know the incidence, epidemiology, the spectrum of the tumors, their biological behaviour and the prognosis of the various types of the tumors. Correlation with clinical features and with radiological findings is always essential to get accurate diagnosis.

Thus, the present study in neuro – oncologic pathology helped to know the status of community and the burden on it regarding CNS primary neoplasms and the integrated key roles of neuro surgeons, radiologists and the pathologists.

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