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Original Research Article.

Histological Analysis of Primary Brain Tumors in a Tertiary Care Hospital: A Retrospective Study of 5 Years

Jayanti Mehta[1], Bhawna Bansal[2*], Alka Mittal[3], Kusum Mathur[4], Ramita Vijay[2]

[1]Professor, [2]PG Resident, [3]Senior Demonstrator, [4]Senior Professor,
Department of Pathology, SMS Medical College & Hospital, Jaipur, Rajasthan, India.

ABSTRACT

Background: Central nervous system neoplasms represent a unique heterogeneous population of neoplasms and include both benign and malignant tumors. The objective of this article is to provide an overview of the descriptive epidemiology of CNS tumors.

Materials and Methods: A total of 1967 cases of CNS tumors were retrieved from the archives of department of pathology, SMS medical college, Jaipur for a period of 5 years. The diagnosis in all the cases was made on histological examination. All cases were confirmed applying revised WHO classification 2007. The relative frequency of tumors and distribution of age and sex were analyzed. IHC was done as and when required.

Results: In our study astrocytic tumor was the most common lesion followed by meningioma. Meningioma was second most common tumor. On the basis of origin of cell type glial cell tumors were most common followed by meningeal tumors. Age distribution in our study showed that tumors were more common in age group of 31 – 40 years followed by 41 – 50 years. According to WHO classification majority of lesions belonged to grade 1 and grade 4.

Conclusion: The most frequent type of CNS tumors in this study was astrocytic tumor followed by meningioma. This study may provide the representative incidence of various types of CNS tumors. A retrospective epidemiological review of brain tumors is particularly important because it can demonstrate the changes in tumor spectrum of a population. Further multicentric studies should be conducted to have substantial data for use in future.

Keywords: Central Nervous System, Neoplasm, Astrocytic Tumor.

***Correspondence to:**

Dr. Bhawna Bansal,
E – 77, Murlipura Scheme,
Bank Colony, Jaipur, Rajasthan, India.

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INTRODUCTION

Central nervous system (CNS) neoplasms represent a unique heterogeneous population of neoplasms and include both benign and malignant tumors. CNS tumors comprise 2% to 5% of all tumors.[1] The annual incidence of tumors of CNS ranges from 10 to 17 per 100,000 people for intracranial tumors and 1 to 2 per 100,000 people for intraspinal tumors; the majority of these are primary tumors and only 1/4th to ½ are metastatic.[2] The majority of patients die within 1st year of diagnosis of malignant lesion and less than 3% survive more than 3 years.[3]

Site of lesion is important because any CNS neoplasm regardless of histologic grade or classification may have fatal consequences if situated in a critical brain region. Seventy percent of childhood CNS tumors arise in the posterior fossa; a comparable number of tumors in adults arise within the cerebral hemispheres above the tentorium.[2]

The age distribution of CNS tumors is said to be bimodal, one peak in children, the second peak in 45-70 yrs of age.[4]

Benign tumors of brain tend to grow slowly and some of them may be cured by surgery with or without radiation therapy. The malignant tumors grow more rapidly and are associated with shorter survival. Some of these highly lethal tumors such as medulloblastoma and ependymoblastoma have a tendency to disseminate throughout the CNS.

The objective of this article is to provide a current overview of the descriptive epidemiology of central nervous system tumors in our hospital setup. Our target was to study incidence of various lesions in light of WHO classification (2007)[5] and study relevant statistics.

MATERIALS ND METHODS

A total of 1967 cases of CNS tumors were retrieved from the archives of department of pathology, SMS medical college, Jaipur from January 2012 to December 2016 during period of 5 years. The diagnosis in all the cases was made on histological examination of processed tissue. All the sections were processed by fixing, dehydration and clearing followed by impregnation with

wax. The wax blocks were cut in 5-6 micron sections and stained by hematoxylin and eosin stain. All cases were confirmed applying revised WHO classification (2007). The relative frequency of tumors and distribution of age and sex were analyzed.IHC is done as and when required. Following Data was collected: Path no, Name, Age, Sex, Site of lesion.

Table 1: Relative frequencies of various tumors according to histological types

HISTOLOGICAL SUBTYPE	NUMBER	PERCENT
TUMORS OF NEUROEPITHELIAL ORIGIN		
Astrocytic Tumors	752	38.2
Oligodendroglioma	156	7.9
Ependymoma	83	4.2
Choroid Plexus Tumors	2	0.1
Astroblastoma	2	0.1
Ganglioglioma	8	0.4
Neurocytoma	10	0.5
Paraganglioma	17	0.8
Pineocytoma	1	0.05
Medulloblastoma	88	4.4
PNET	3	0.1
Atypical Teratoid	1	0.05
TUMORS OF CRANIAL AND PARASPINAL NERVES		
Schwannoma	246	12.5
Neurofibroma	17	0.9
MPNST	2	0.1
TUMORS OF MENINGES		
Meningioma	489	24.9
Solitary Fibrous Tumor	1	0.05
Hemangiopericytoma	6	0.3
Hemangioblastoma	10	0.5
LYMPHOMAS AND HEMATOPOIETIC NEOPLASMS		
Plasmacytoma	10	0.5
Lymphoma	16	0.8
GERM CELL TUMOR		
Germionoma	1	0.05
Teratoma	1	0.05
TUMORS OF SELLAR REGION		
Craniopharyngioma	45	2.3
TOTAL	**1967**	**100**

RESULTS

A total of 1967 cases of CNS tumors were retrieved from the archives of department of pathology, SMS medical college, Jaipur from January 2012 to December 2016 during period of 5 years.

In our study most common lesion was astrocytoma followed by meningioma. We observed 752 cases of astrocytoma out of total 1967 cases of CNS tumors. Meningioma was second most common tumor (489 cases of all CNS tumors). 83 cases of ependymoma were seen. 246 cases of schwannoma and 156 cases of oligodendroglioma were seen.

According to origin of cell type tumors of neuroepithelial origin (n = 1123) were most common followed by meningeal tumors (n = 506). Tumors of cranial and paraspinal nerves were 265 cases (schwannoma + neurofibroma + MPNST) were seen and 88 cases of medulloblastoma were seen.

In our study we found that astrocytic tumors were more common in males whereas meningeal tumors were more common in females. Ependymoma was also commonly seen in males. Craniopharyngioma and hemangioblastoma were also seen more in males. Overall CNS tumors showed predilection for males (n = 1084) in comparison to females (n = 883). Male to female ratio was 1.23: 1.

Age distribution in our study showed that tumors were more common in age group of 31 – 40 years (n = 436) followed by 41 – 50 years (n = 399). Majority of CNS lesions were seen in 31 – 50 years of age group (835 out of 1967 accounting to nearly 42.5 % of cases). Age group from 0 – 10 yrs revealed a total of 152 tumors among which 42 cases of medulloblastoma, 16 cases of ependymoma, 54 cases of astrocytoma and 14 cases of

craniopharyngioma were present. 213 lesions were noticed in 11 – 20 yrs of age group and 330 lesions were noticed in 21 – 30 yrs of age group. 3 lesions were noticed in 81 – 90 yrs of age group. Our study showed frontal lobe to be the commonest site for primary brain tumors. According to WHO classification 1586 cases were graded, in which majority of lesions belonged to grade 1.

Table 2: Sex wise distribution of various tumors

HISTOLOGICAL SUBTYPE	MALES	FEMALES
Astrocytic Tumors	472	280
Oligodendroglioma	104	52
Ependymoma	46	37
Choroid Plexus Tumors	1	1
Astroblastoma	1	1
Ganglioglioma	5	3
Neurocytoma	8	2
Paraganglioma	10	7
Pineocytoma	1	-
Medulloblastoma	60	28
PNET	3	-
Atypical Teratoid	1	
Schwannoma	137	109
Neurofibroma	5	12
MPNST	2	0
Meningioma	164	325
Solitary Fibrous Tumor	1	-
Hemangiopericytoma	2	4
Hemangioblastoma	7	3
Plasmacytoma	10	0
Germionoma	-	1
Teratoma	-	1
Craniopharyngioma	32	13
Lymphoma	12	4
TOTAL	1084	883

Table 3: Age wise distribution of CNS tumors

HISTOLOGICAL SUBTYPE	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90
Astrocytic Tumors	54	93	121	160	139	106	63	14	2
Oligodendroglioma	4	14	28	53	36	16	4	-	1
Ependymoma	16	15	22	18	8	4	-	-	-
Choroid Plexus Tumors	1	-	-	-	-	1	-	-	-
Astroblastoma	1	-	-	1	-	-	-	-	-
Ganglioglioma	1	5	2	-	-	-	-	-	-
Neurocytoma	1	2	3	2	-	2	-	-	-
Paraganglioma	1	-	5	3	6	1	-	1	-
Pineocytoma	-	-	1	-	-	-	-	-	-
Medulloblastoma	42	20	8	7	4	7	-	-	-
PNET	1	2	-	-	-	-	-	-	-
Atypical Teratoid	1	-	-	-	-	-	-	-	-
Schwannoma	2	19	64	63	55	26	12	5	-
Neurofibroma	3	3	6	2	2	1	-	-	-
MPNST	-	-	-	1	1	-	-	-	-
Meningioma	7	24	60	110	136	88	52	12	-
Solitary Fibrous Tumor	-	-	-	-	-	-	1	-	-
Hemangiopericytoma	-	-	3	1	1	-	1	-	-
Hemangioblastoma	-	2	1	4	1	1	1	-	-
Plasmacytoma	-	-	-	2	3	5	-	-	-
Germionoma	1	-	-	-	-	-	-	-	-
Teratoma	1	-	-	-	-	-	-	-	-
Craniopharyngioma	14	11	6	5	5	3	1	-	-
Lymphoma	1	3	2	4	2	1	2	1	
TOTAL	152	213	332	436	399	262	137	33	3

Table 4: CNS tumors distribution and grading according to WHO classification

HISTOLOGICAL SUBTYPE	Grade 1	Grade 2	Grade 3	Grade 4	Total
Astrocytic Tumors	98	214	77	363	752
Oligodendroglioma	2	95	58	1	156
Ependymoma	25	50	8	-	83
Ganglioglioma	5	3	-	-	8
Neurocytoma	-	4	6	-	10
Medulloblastoma	-	-	-	88	88
Meningioma	468	19	2	-	489
TOTAL	598	385	151	452	1586

DISCUSSION

Brain tumors appear to show an increasing trend over the past 30 yrs, but the rise probably results mostly from the use of new neuroimaging techniques. Treatments have not improved prognosis for the most rapidly fatal brain tumors. Established brain tumor risk factors (exposure to therapeutic ionizing radiations, rare mutations of parental genes and family history) explain only a small proportion of brain tumors. Among associations currently being investigated, those of interest include reproductive and menstrual factors for glioma and meningioma, cell phone use for glioma and acoustic neuroma, familial aggregation for meningioma, allergic conditions for glioma, and a variety of inherited polymorphisms potentially associated with glioma.

A prior hypothesis will be needed for these studies and for studies involving genetic polymorphisms that, in conjunction with environmental carcinogens or behavioral factors, may increase brain tumor risk. In addition to these promising leads, new hypotheses should consider previous findings from well-established risk factors, such as gender, race and ethnicity. New concepts in brain tumor etiology and clinical management are the goal of such research, with an aim at eradicating this devastating disease.

In our study the distribution of all CNS tumors according to age showed a gradual increase in tumor cases with increasing age, highest in the age group 31-50 years and decreasing thereafter.

Fan et al reported proportionally low frequencies of CNS tumors at both ends of age spectrum (below 10 years old and greater than 70 years). The highest frequency was noted in the 50-59 year age group.[6] The rise in incidence of brain tumors is consistent with virtually all other adult tumors.[7]

Mean age of patients having brain tumors vary between different populations. A possible explanation for this is aging populations in developed countries.[8]

The mean age of patients diagnosed with meningiomas in one European report was 57.6 years, in an American report 59 years and in an Asian report 58.1 years.[8-10] Barker et al found a peak incidence of meningiomas in the age group 60-69 years.[11]

The peak age group for this tumor type in our study was considerably younger (41-50 years). The meningioma in our study showed increased in incidence in the 3rd and 4th decade and with the most cases occurring in the range of 41-50 years.

According to balkishan B yeole et al[3] too, brain - nervous system cancer were more common in males than females but according to lee et al[9] CNS tumors occurred in females more often than in males (female: male ratio 1.43:1)

Rachet et al proposed that brain tumors are 20-50% more common in men in western nations.[12] The life time risk of being diagnosed with a CNS malignancy is estimated to be 0.67% for men and 0.52% for women.[13] In separate studies performed on two continents, Mckinney et al, and Fan et al found comparable results suggesting a male to female ratio of 1.5:1.[6,7.] In our study male to female ratio was 1.23:1.

Ganghoria S et al found that astrocytoma was commoner in males than females. 68.75% of astrocytoma was seen in males and male to female ratio was 1:0.86.[14] According to Surawicz et al gliomas affect about 40% more males than females.[15] Barker et al found the incidence of malignant gliomas to be especially higher among male patients.[11] The male to female ratio noticed in our study was 1.685 :1. The male predominance was seen in all ages.

Tumors of neuroepithelial origin were more frequently seen in male patients.[11,15,16.] In Our study we found male to female ratio as 1.73:1 in patients with tumors of neuroepithelial origin.

A review of data obtained from SEER program suggested a higher incidence of meningiomas in females across all ages, while Wiemels et al found that the previously described two fold predominance of female meningioma cases may be inverted in the rare cases of prepubertal meningiomas.[17] In our study, tumors of meningeal origin (comprised predominantly of meningiomas) were found more in female patients, with male: female ratio of 0.52:1.

Medulloblastomas and PNET had male predominance in the CBTRUS study.[15] In our study, from a total of 88 cases of medulloblastoma 60 were males and all 3 cases of PNET were males.

In our study we found astrocytoma to be the most common tumor (38.34%) followed by meningioma (24.93%). The same was found by Aryan G. et al in Nepal who noticed that astrocytomas were most common tumors of CNS followed by meningiomas.[18]

In contrast to our study meningioma was most common tumor as noted by Ganghoria S. et.al.[14] The same was in favor with surawicz et al[15] in USA. Lee et al[9] in korea also found that most common tumor was meningioma (31.2%).

The second most common type of primary CNS tumor in our study was meningioma (24.93%) followed by peripheral nerve sheath tumors (13.41%) and oligodendrogliomas (7.7%). There were 88 cases of medulloblastoma (4.48%) and 83 cases of ependymoma (4.23%) and 45 cases of craniopharyngioma (2.29%).

Frontal lobe was the most common site of involvement in brain tumors. This is in favor to the findings of Torres et al[19], Andrews et al[20], Jalali and Dutta[21], Jamal et al.[22]

Histological grading is a means of predicting the biological behavior of neoplasm. The grading factors tremendously affect the choice of therapy. The commonest type of astrocytoma in our

study was WHO grade 4 type. A possible cause of this may be linked to their late presentation to hospital. According to WHO classification 1586 cases were graded, in which majority of lesions belonged to Grade I.

It is hard to compare the different studies due to differences in the case material and study techniques. This study may not represent an accurate incidence of CNS tumors in West India (Rajasthan) due to limited number of cases. Furthermore the study was based on a single tertiary care hospital analysis

CONCLUSION

The most common type of CNS tumors in this study was astrocytoma followed by meningioma. This study may provide the representative incidence of various types of CNS tumors.

A retrospective histopathological analysis of brain tumors is definitely important for future research because it can reveal the changes in tumor spectrum of a population. As the geographic area changes, histopathology of tumors change which affect the management. Further nationwide multicenter studies should be conducted to have substantial data for purpose of research in future.

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