

## Original Research Article

# A study on morphologic and histological pattern of the central nervous system tumors

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### ABSTRACT

**Background:** It has been revealed by International Agency for Research on Cancer that the worldwide incidence rate of CNS tumors in 2002 was 3.7/100,000 population among males and 2.6/100,000 population among females. Central Nervous System (CNS) tumors account for 85% of brain tumors and 15 % of spinal cord tumors, however metastatic tumors are usually extradural. According to the WHO classification tumors of CNS comprise more than 50 clinicopathological entities. The major categories include the tumors of neuroepithelial tissue, cranial and paraspinal nerves, meninges, sellar region, lymphomas haematopoietic neoplasms, germ cell and metastatic tumors. An understanding of the epidemiology is needed to facilitate prevention, early detection and treatment of CNS tumours.

**Methods:** The study was conducted in the Department of Pathology, Pt. J.N.M. Medical College Raipur, India from January 2009 to August 2017. The present study was a retrospective study; hence H and E section of every case was re-examined and histopathological reports were reviewed. Sections were stained with H&E. Diagnosis is made according to the WHO classification and diagnostic criteria for CNS neoplasms.

**Results:** CNS tumours occur more frequently in the age group of 41-50 years (57 cases -21.1%) followed by 31-40 years (53 cases -19.7%). The most common entity in the present study were tumours of neuroepithelial tissue 127 cases (47.2%) followed by tumors of meninges 59 cases (22%) and nerve sheath tumours 42 cases (15.6%). The tumors of neuroepithelial tissue comprised mainly of astrocytic tumors 86 cases (32%) followed by embryonal tumors 15 cases (5.6%), ependymal tumors 11 cases (4.1%), oligodendroglial tumors 09 cases (3.3%).

**Conclusions:** Within the scope and limitations of the present study we believe that this effort would help in establishing the grounds for future epidemiologic studies that would, eventually, contribute to give insight into the epidemiology of CNS tumors.

**Keywords:** Astrocytoma, CNS tumors, Meningioma, Neuroepithelial tumors

### INTRODUCTION

It has been revealed by International Agency for Research on Cancer that the worldwide incidence rate of CNS tumors in 2002 was 3.7/100,000 population among males and 2.6/100,000 population among females. The incidence rates were higher in developed countries (males: 5.8/100,000; females: 4.1/100,000) than in developing countries males: 3.0/100,000; females:

2.1/100,000). In 2008, the rates had risen to 3.8/100,000 in males and 3.1/100,000 in females, although the incidence rates in developed countries (males: 5.8/100,000; females: 4.4/100,000) still remained higher than those in developing countries (males: 3.2/100,000; females: 2.8/100,000).<sup>1</sup>

Central Nervous System (CNS) tumors account for 85% of brain tumors and 15 % of spinal cord tumors, however

metastatic tumors are usually extradural. These tumors account for about 2% of all cancer deaths. Most of these are idiopathic.<sup>2</sup>

According to the WHO classification tumors of CNS comprise more than 50 clinico-pathological entities. The major categories include the tumors of neuroepithelial tissue, cranial and paraspinal nerves, meninges, sellar region, lymphomas haematopoietic neoplasms, germ cell and metastatic tumors.<sup>3</sup>

The etiology of primary brain tumors is likely to vary with the histologic type of the tumor and tissue origin, even though the possibility of overall etiologic factors exists. A wide range of possible etiologic factors have been evaluated, such as genetic factors and environmental determinants, encompassing physical, chemical, and biologic agents. Known risk factors such as exposure to high doses of ionizing radiation to the head during childhood and hereditary factors such as neurofibromatosis and tuberous sclerosis are uncommon and explain only a small proportion of all brain tumor cases. Moreover, the variation in age, gender and ethnic group-specific incidence of different subtypes of primary brain tumors supports the idea of differences in etiology.

Introduction of radiologic imaging technologies such as computed tomography (CT) during the 1970s and magnetic resonance imaging (MRI) during the 1980s, together with stereotactic biopsy have significantly enhanced the diagnosis of brain tumors.<sup>4</sup>

About 70% of the intracranial tumors are supratentorial in adults, the most common being astrocytomas followed by meningiomas and metastatic tumors, whereas 70% of the tumors in children are infratentorial, most common of which are astrocytomas followed by medulloblastomas.<sup>2</sup>

Characterizing the different forms and range of CNS neoplasms in different regions may provide etiological clues to some tumor types. The unparalleled complexity of the CNS is mirrored by the ever increasing diversity of recognizing neoplastic entities that can afflict the organ. The major classes of primary brain tumors to be considered here include gliomas, neuronal tumors, poorly differentiated tumors, and a group of other less common tumors. The five most common primary sites are lung, breast, skin (melanoma), kidney and gastrointestinal tract accounting for about 80% of all metastases. Some rare tumors (e.g., choriocarcinoma) have a high likelihood of metastasizing to the brain.<sup>5</sup>

An understanding of the epidemiology is needed to facilitate prevention, early detection and treatment of CNS tumours. Most of the patients with neoplasm has fairly characteristic presentation. However, many patients with intracranial masses present a greater diagnostic challenge because of atypical presentation secondary to intratumoural hemorrhage, arterial occlusion and cerebral infarction or tumour involvement of silent areas. In such

cases it is important to utilize modern neuro-radiological procedures in order to detect the lesion to localize it and thus predict the histological tumour type.<sup>6-8</sup>

The present study is an attempt to evaluate the morphologic and histological pattern of the CNS tumours with a view to have insight into the prevalence and spectrum of CNS neoplasms in our region due to rarity of studies on the subject.

## METHODS

The present retrospective study was conducted in the Department of Pathology, Pt.J.N.M. Medical College Raipur C.G, India during study period from 1<sup>st</sup> January 2009 to 30<sup>th</sup> August 2017. A total of 269 cases were included during study period. H and E section of every case was re-examined, and histopathological reports were reviewed. Patients attended neurosurgery department were selected as a study subject. The clinical information was obtained from case records of patients retrieved from Department of Neurosurgery. Sections were stained with H&E. Diagnosis is made according to the WHO classification and diagnostic criteria for CNS neoplasms.

### *Inclusion criteria*

Specimen of patients including spinal cord and meninges of any size, age, sex and location who have been diagnosed clinically and radiologically as central nervous system neoplasia undergone histo-pathological examination following surgery was included in this study.

### *Exclusion criteria*

Inadequate biopsy, autolysed/necrosed tissue specimen, non-neoplastic lesions, neurological lesions other than lesions of the central nervous system were excluded from study.

Data was compiled in MS Excel and checked for its completeness and correctness. Then it was analyzed using online statistical calculator.

## RESULTS

Patient's ages ranged from 1 year to 78 years. CNS tumours occur more frequently in the age group of 41-50 years (57 cases -21.1%) followed by 31-40 years (53 cases -19.7%). Least number of cases is seen in the age of 71-80 years (02 cases-0.7 %) followed by 61-70 years (16 cases-5.9%). There was slight preponderance in males 138 cases (51.3%) whereas females show an incidence of 131 cases (48.7%) (Table 1).

The most common entity in the present study were tumours of neuroepithelial tissue 127 cases (47.2%) followed by tumors of meninges 59 cases (22%), nerve sheath tumours 42 cases (15.6%), sellar region tumours

36 cases (13.5%), metastatic tumors 3 cases (1.2%), and hemotolymphoid neoplasm 2 cases (0.4%) (Table 2).

**Table 1: Age and sex distribution of CNS tumours.**

Group	Male	Female	Total	%
0-10	16	13	29	10.7
11-20	17	16	33	12.3
21-30	20	25	45	16.7
31-40	25	28	53	19.7
41-50	29	28	57	21.1
51-60	16	18	34	12.6
61-70	14	2	16	5.9
71-80	1	1	2	0.7
Total	138	131	269	100.0

**Table 2: Distribution of main histological types of CNS tumours.**

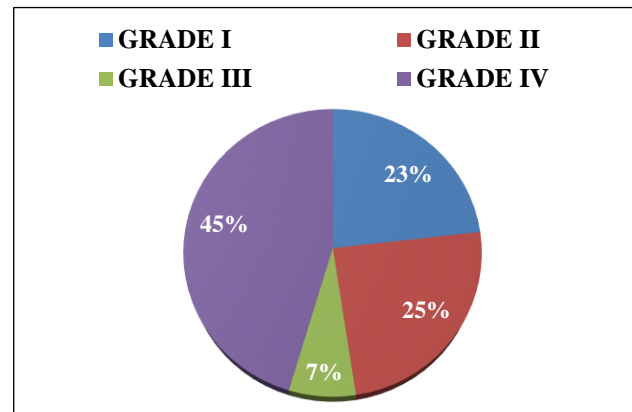
Histological type	No. of cases	%
Neuroepithelial	127	47.2
Nerve sheath tumours	42	15.6
Tumours of meninges	59	21.93
Sellar region tumours	36	13.38
Germ cell tumours	0	0
Metastatic tumours	3	1.1
Haematopoietic tumours	2	0.74
Total	269	100%

**Table 3: Histological subtypes of CNS neoplasm.**

Histological type	Male	Female	Total	%
Astrocytoma	55	31	86	32
Meningioma	23	31	54	20
Schwannoma	16	26	42	16
Pituitary adenoma	10	11	21	7.8
Craniophyngioma	10	5	15	5.6
Medulloblastoma	8	7	15	5.6
Ependymoma	6	5	11	4.1
Oligodendroma	2	7	9	3.3
Metastatic tumour	2	1	3	1.1
Hemangioblastoma	2	1	3	1.1
Lymphoma	-	2	2	0.7
PNET	1	1	2	0.7
Choroid plexus papilloma	-	1	1	0.4
Hemangiopericytoma	1	-	1	0.4
Pineocytoma	1	-	1	0.4
Neurocytoma	1	-	1	0.4
Gangliosarcoma	-	1	1	0.4
Hemangioendothelioma	1	-	1	0.4
Total	142	127	269	100
P value >0.05 non-significant				

The tumors of neuroepithelial tissue comprised mainly of astrocytic tumors 86 cases (32%) followed by embryonal tumors 15 cases (5.6%), ependymal tumors 11 cases (4.1%), oligodendroglial tumors 09 cases (3.3%).

Primitive neuro-ectodermal tumor (PNET), Neurocytoma, Choroid plexus papilloma were diagnosed in one patient each accounting for 0.4% each of all tumors derived from neuroepithelial tissue. No significant association was found between CNS tumours and gender (p>0.05). Among the astrocytic tumors, Glioblastoma multiforme Grade IV (45.4%) was the commonest type followed by diffuse astrocytoma Grade II (24.4%), Grade I (23.1%) and Grade III (7.0%). Second most frequently occurring tumour subtype were belong to tumour derived from the meninges. A total of 54 (20%) cases of Meningioma were diagnosed in the study period. Age was ranging from 35 years to 69 years, 23 cases were male and 31 cases were female (Table 3 and Figure 1).



**Figure 1: Astrocytoma relative frequency.**

**DISCUSSION**

In the present study astrocytomas were the commonest tumors (86 cases) constituting 32% of all CNS neoplasms. Masoodi et al, Jat KC et al, Mollah et al and Aryal G et al, also reported astrocytomas to be the commonest tumors in their respective studies.<sup>3,5,7,9</sup> However, meningiomas made up the largest subgroup of studies conducted by Ghanghoria S et al, similar result found in the study done by Surawicz et al, in USA and Lee et al in Korea.<sup>6,10,11</sup>

In this study, among astrocytomas, glioblastoma was the commonest (39 cases, 45.4%) similar to that observed by other workers, but study done by Sumithi V et al, found grade II is the commonest, which may be due to subjective differences in grading systems.<sup>12</sup>

Meningiomas were the second commonest tumors (54 cases) constituting 20% of all CNS neoplasms. Similar observations were made by Masoodi et al, Jat KC et al, and Aryal G et al.<sup>3,5,9</sup> 21 cases (7.8%) of pituitary adenomas were reported similar to that reported by Aryal G et al.<sup>9</sup> Ependymoma constituted 4.1% of all CNS neoplasms which is comparable to 4.0% and 4.7% incidence reported by Masoodi et al and Mollah et al.<sup>3,7</sup> Medulloblastoma constituted 5.6% of all CNS neoplasms which is agreeable to 6.1% and 4% incidence reported by Ghanghoria S et al, and Mollah et al.<sup>6,7</sup>

Oligodendroglial tumors, represented 3.3% of the CNS neoplasms which is similar to that reported by Masoodi et al, and Jat KC et al.<sup>3,5</sup>

There is general agreement on the differences in the age incidence of different tumour types, astrocytomas could be found at any age from infancy to over 70 years, oligodendrogliomas are most commonly seen in adults but not uncommon in childhood or adolescence. In this study the age incidence was maximum in the group of 3<sup>rd</sup> to 5<sup>th</sup> decade. Similar observation made by Masoodi et al, and Ghanghoria S et al.<sup>3,6</sup>

This study showed age range of 03 to 78 years. Which is similar to studies conducted by Mohammad Sajjad et al, Ghanghoria et al, showed age range of 09-70, 1-85 years, respectively.<sup>2,6</sup>

The most of western as well as Indian studies shown a male preponderance. In current study male to female ratio is 1.05:1. Almost the same male dominant ratio of 1: 0.86 is shown by Ghanghoria et al, whereas Aryal G et al, showed equal male to female ratio But Lee et al found females predominance (female to male, 1.43: 1).<sup>6,9,11</sup>

## CONCLUSION

Within the scope and limitations of the present study we believe that this effort would help in establishing the grounds for future epidemiologic studies that would, eventually, contribute to give insight into the epidemiology of CNS tumors.

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