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Incidence of the Histological Types of Tumors of the Central Nervous System – A Hospital Based Study

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Abstract: ***Background: The tumors of the Central nervous system (CNS) include tumors of the brain and spinal cord. Primary CNS tumors are not common. However the incidence of CNS tumors has been rapidly increasing at recent times.[1] Aims and Objectives: The aims of this study were to determine the relative frequencies of tumors of central nervous system (CNS), their age and sex distribution. It was a hospital based study. Methods: The study group comprises of a total of 60 cases of tumors of CNS who have been clinically and radiologically diagnosed as such in the department of Neurosurgery, department of Pediatric surgery and department of General surgery in GMCH.The patients are of all ages and both sexes who have been operated for clinically indicated reasons. Result: CNS tumors are more common in adults with 50 cases (83%) than children with 10 cases (17%). Tumors of the CNS are more common in males than females in both children (≤19 years) and adults (>19 years) with a M:F ratio of 1.5:1 and 1.17:1 respectively. In adults meningioma was the commonest histology among all primary CNS tumors with 22 cases (44%). In children astrocytomas were found to be the commonest with 6 cases (60%). In adults the most common site of CNS tumor was found to be meninges (23 cases, 46 %). In children the most common site was cerebellum (6 cases, 60 %). Intracranial tumors were more common with 48 cases (80%) than spinal cord tumors with 12 cases (20%). Among the spinal cord tumors meningioma was the most common (8 cases, 66.7%) followed by schwannoma (3 cases, 25%) and ependymoma (1 case, 8.3%). Conclusion: CNS tumours vary considerably in their histological and gender distribution throughout childhood and adulthood. CNS tumors in adults have a relatively high frequency as compared to children. Even though most patients with high grade gliomas have a dismal prognosis, long-time survivors are seen in all histologic groups and illustrate the heterogeneity of these tumors.[2]***

Keywords: Central nervous system(CNS), Histological, Glioblastoma multiforme (GBM), Meningioma

1. Introduction

The Central nervous system (CNS) include the brain and spinal cord.The brain as well as the spinal cord are surrounded by three layers of membranes (the meninges)-a tough, outer layer (the dura mater), a delicate, middle layer (the arachnoid mater), and an inner layer firmly attached to the surface of the brain (the pia mater).The cerebral hemisphere have distinct fissures which divide the brain into lobes, frontal, parietal, temporal and occipital. The brain receives its arterial supply from two pairs of vessels, the vertebral and internal carotid arteries which are interconnected in the cranial cavity to produce an arterial circle (of willis).[3] The central nervous tissue consists of neurones and support cells known as neuroglia. Four principal types of neuroglia are: oligodendrocytes, astrocytes, micoglia and ependymal cells.[4] 70% of childhood CNS tumors arise in the posterior fossa; a comparable number of tumors in adults arise within the cerebral hemisphere above the tentorium. The major classes of brain tumors include gliomas, neuronal tumors, poorly differentiated tumors as well as a collection of other tumors. Meningiomas are the most frequently diagnosed primary brain tumor accounting for 33.8% of all primary CNS tumors. The most common primary malignant neoplasm is glioblastoma multiforme. It accounts for 16 % of all primary brain tumors. Metastatic lesions, mostly carcinomas account for approximately a quarter to half of intracranial tumors in hospitalized patients. The five most common primary sites are lung, breast, skin (melanoma), kidney and gastrointestinal tract accounting for 80% of all metastases.[5] Males have a significantly higher rate of neuroepithelial tumors and lymphomas than females. Meningioma represents the only primary intracranial tumor of which females dominate.[6] Apart from ionizing radiation, no other known risk factors are associated with intracranial neoplasms.[7, 8] Prognosis varies considerably depending on type of tumor. Glioblastoma multiforme (GBM) are among the most aggressive with a mean survival of approximately 12 months despite surgical resection, radiotherapy and chemotherapy.[2]

2. Materials and Methods

The study was carried out in 60 cases of clinically diagnosed tumors of the CNS in the Department of Pathology, Gauhati medical college hospital, Guwahati, Assam, India during the period July 2012 to June 2013. The study group comprises of patients of all ages and both sexes who have been operated for clinically indicated reasons.

Inclusion criteria: Cases which have been diagnosed clinically and radiologically as tumors of the central nervous system and operated for clinically indicated reasons.

Exclusion criteria: Cases that have been clinically and radiologically reported other than the tumors of the central nervous system.

The specimens were received from the department of Neurosurgery, General surgery of Gauhati Medical College hospital. Grossing and routine tissue processing was done.

The slides stained with H& E were examined first under low power and then under high magnification. For histopathological diagnosis of CNS tumors, the 2007 WHO classification of CNS tumors was followed.

3. Results

Of the 60 cases of tumors of the CNS examined histopathologically in the department of Pathology, we found 50 cases in adults(83%).The M:F ratio was 1.17:1 and 1.5:1 for adult (>19 years) and pediatric (<19 years) cases and the overall ratio was 1.22:1. In adults meningioma was the commonest histology among all primary CNS tumors with 22 cases (44%) followed by glioblastoma multiforme with 8 cases (16%) and nerve sheath tumors with 7 cases (14%) .In children astrocytomas were found to be the commonest with 6 cases (60%). In adults the most common site of CNS tumor was found to be meninges (23 cases, 46 %) followed by the cerebral lobes(16 cases, 32%). Cranial and paraspinal nerves was the third most common site with 7 cases(14%) In children the most common site was cerebellum(6 cases, 60 %). Infratentorial brain tumors(70%) are more common than supratentorial brain tumors (30%) in children(<19 years). Intracranial tumors were more common with 48 cases (80%) than spinal cord tumors with 12 cases (20%). Among the spinal cord tumors meningioma was the most common (8 cases, 66.7%) followed by schwannoma (3 cases, 25%) and ependymoma (1 case, 8.3%).

Table 1: Showing incidence of adult and pediatric CNS tumors

Age group	*No of cases(n)*	*Percentage (%)*
Adult (>19 yrs)	50	83
Paediatric (≤19 yrs)	10	17
Total	60	100

Table 2: Showing sex specific incidence

Age group	*Male*		*Female*		*M:F Ratio*
	No of cases(n)	*Percentage (%)*	*No of cases(n)*	*Percentage (%)*	
Pediatric (≤19 yrs)	6	60	4	40	1.5:1
Adult (>19 yrs)	27	54	23	46	1.17:1
Total	33	55	27	45	1.22:1

Table 3: Distribution according to specific histology

Histology	*Adult(>19 yrs)*		*Pediatric(≤19 yrs)*	
	No of cases(n)	*Percentage (%)*	*No of cases(n)*	*Percentage (%)*
Astrocytomas	6	12	6	60
GBM	8	16	0	0
Oligodendrogliomas	2	4	0	0
Ependymomas	2	4	0	0
Medulloblastoma	0	0	2	20
Nerve sheath tumors	7	14	0	0
Meningiomas	22	44	1	10
Craniopharyngiomas	2	4	1	10
Germ cell tumors	0	0	0	0
Pituitary tumors	0	0	0	0
Lymphomas	0	0	0	0
All others	1	2	0	0
Total	50	100	10	100

Table 4: Distribution according to site

Site	Adult (>19 yrs)		Pediatric(≤19 yrs)	
	No of cases(n)	Percentage (%)	No of cases(n)	Percentage (%)
Meninges	23	46	1	10
Cerebral lobes	16	32	1	10
Cerebellum	0	0	6	60
Brain stem	0	0	0	0
Ventricles	1	2	0	0
Sellar region	2	4	2	20
Cranial and paraspinal nerves	7	14	0	0
Spinal cord/Cauda equina	1	2	0	0
Total	50	100	10	100

Table 5: Distribution of paediatric brain tumors according to compartment

Site	*No of cases (n)*	*Percentage (%)*
Supratentorial	3	30
Infratentorial	7	70
Total	10	100

Table 6: Showing distribution of intracranial and spinal cord tumors

Site	*No of cases(n)*	*Percentage(%)*
Intracranial	48	80
Spinal	12	20
Total	60	100

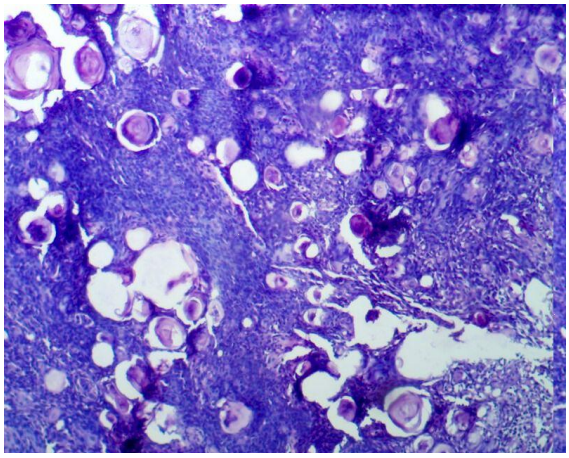
Table 7: Showing distribution of spinal cord tumors by specific histology

Histology	*No of cases(n)*	*Percentage (%)*
Meningioma	8	66.7
Schwannoma	3	25
Ependymoma	1	8.3
Total	12	100

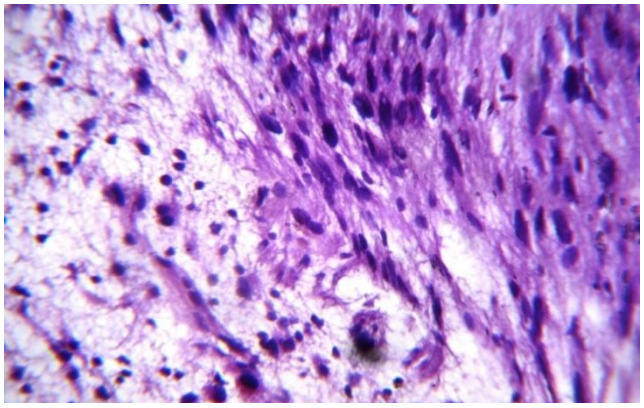
4. Discussion

- The histology and location of CNS tumors differ in children and adults. The annual incidence of tumors of the Central Nervous System (CNS) ranges from 10 to 17 per 1, 00, 000 persons for intracranial tumors and 1 to 2 per 1, 00, 000 persons for intraspinal tumors, about half to three quarters are primary tumors and the rest are metastatic.[5] The incidence of intracranial tumors in general and of specific histologic types of intracranial tumors differs by racial and ethnic group, sex, age, Geography and even social class.
- In a 4 year study by CBTRUS 2012 on 295, 986 cases of primary brain and CNS tumors, 7 % of the cases were in individuals less than 20 years and 93% were in individuals 20 years of age or older at the time of diagnosis.[9] Of the 60 cases of CNS tumors studied, most tumors (88.3%) were recorded in the age range of 21 to 60 years with peak in the age group of 41-50 years and a mean age of 46.5 years. Katchy et al (2013) found 63 % of the brain tumors in the age group 20 -64 years.[10] The presenting symptoms of CNS tumors are headache, nausea, vomiting, seizure, decreased vision, decreases hearing, changes in behaviour or personality, speech difficulties, gait disturbance, weakness of limbs and changes of sensation.

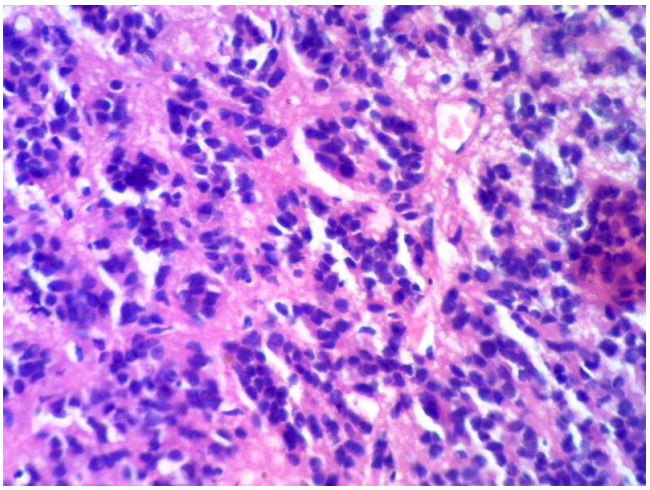
- According to Sun et al (2012), there is a clear predominance of brain tumors in males.[11] Arora et al (2009) found a M:F ratio of 1.17:1 in a study of 54336 primary CNS tumors which tallies with the present study.[12]
- According to Central brain tumor registry of the United States(CBTRUS) statistical report 2012 the most common site of brain and CNS tumors was meninges(34%) followed by the cerebral lobes (22%). The cranial nerves and the spinal cord/cauda equina account for 7% and 3% of all tumors, respectively [9] Ahmed et al reported in a series of 81 pediatric brain tumors (<15 years) 66.7 % infratentorial and 33.3% supratentorial tumors.[13]
- Since this work was carried out in a limited period of time with a small number of cases, it is envisaged that a further long term comprehensive study will throw more light and help in formulating ways and means to control tumors of the CNS in this region in future by early diagnosis and treatment.



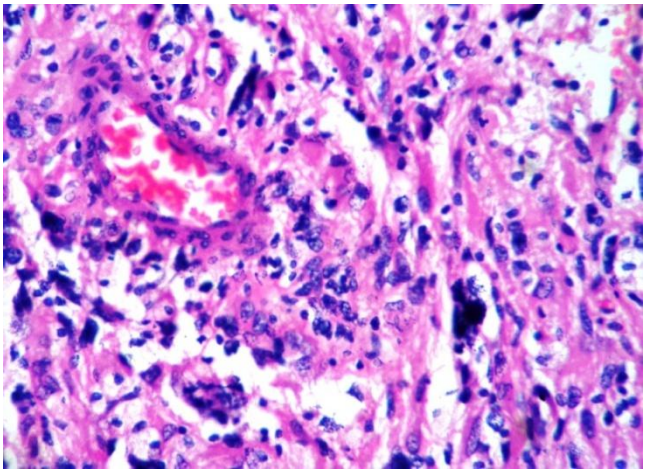
Photomicrograph of high power(H&E stain x400) of Psammomatous meningioma



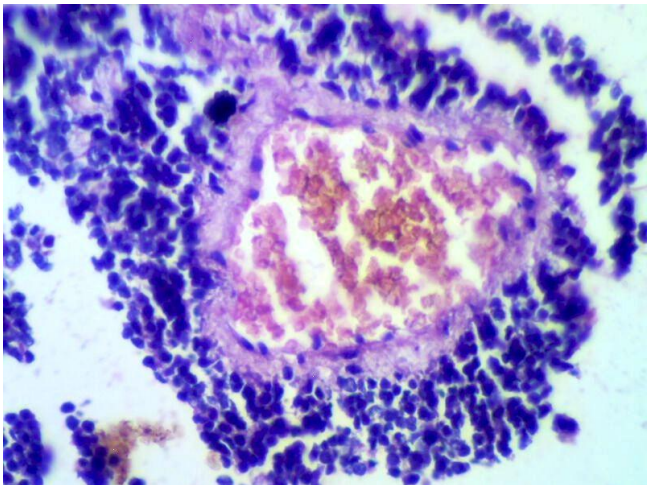
Photomicrograph of high power (H&E stain X400) of Pilocytic astrocytoma



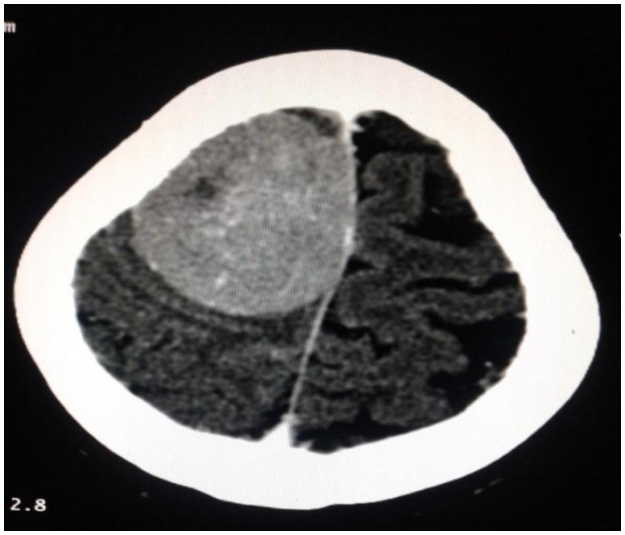
Photomicrograph of high power (H&E stain X400) of Medulloblastoma



Photomicrograph of high power (H&E stainX400) of Glioblastoma multiforme



Photomicrograph of high power (H&E stain x400) of Ependymoma- perivascular pseudorosette



CECT Brain-Right parasaggital meningioma

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