ORIGINAL ARTICLE

SPECTRUM OF CENTRAL NERVOUS SYSTEM TUMOURS–A SINGLE CENTER HISTOPATHOLOGICAL REVIEW OF 761 CASES OVER 5 YEARS

Javaria Ahsan, Shohaib Naiyar Hashmi, Iqbal Muhammad, Hafeez Ud Din, Ahsan Masood Butt*, Sajid Nazir, Muhammad Azhar**

Department of Histopathology, Armed Forces Institute of Pathology, Rawalpindi *Department of Surgery, Combined Military Hospital, Rawalpindi, Department of Neurosurgery, Ayub Medical College, Abbottabad-Pakistan

Background: The incidence of central nervous system (CNS) tumours has rapidly increased over the past few years. There is no accurate nationwide CNS tumour epidemiology in Pakistan that makes policy making for tumour screening and early treatment difficult. The purpose of this study was to provide the spectrum of CNS tumours in a premier diagnostic and referral centre of Pakistan. **Methods**: This cross-sectional study was carried out at Histopathology Department, Armed Forces Institute of Pathology over a period of 5 years. A total of 761 cases patients who were diagnosed with CNS tumours on histopathology, both benign and malignant, belonging to both genders, between the ages of 1–85 years, from 11.2009 to 31.12.2013 were included in the study. **Results:** Seven CNS tumour categories were as follows; tumours of neuroepithelial tissue (56.0%), tumours of the meninges (28.3%), tumour of the sellar region (2.6%), germ cell tumour (0.1), tumour of cranial and paraspinal nerves (5.4%), lymphomas and haematopoietic neoplasm (2.4%), metastatic tumours (4.9%), where histological types by age and gender showed great variability. Astrocytic tumours were the commonest neuroepithelial tumours (69.4%). Glioblastoma multiform forming the largest subtype of neuroepithelial tumours (40.4%) with a mean age at diagnosis being 47.1 years. Overall, males exceeded females in number of most of the CNS tumour types, however meningeal tumours were more frequently noted in females. **Conclusions:** Neuroepithelial tumours are commonest tumour and comprise more than half of all operated CNS tumours in our setup, followed by meningeal tumours. Glioblastoma multiforme is largest subtype of neuroepithelial tumour, and comprising 40.4% of all.

Keywords: Central nervous system, Neuroepithelial tumours, Meningeal tumours, Glioblastoma multiforme

J Ayub Med Coll Abbottabad 2015;27(1):81–4

INTRODUCTION

Central nervous system tumours are not very common. However, the incidence of CNS tumours has rapidly increased over the past few years.[1,2] The worldwide incidence of primary malignant brain and CNS in 2008, was 3.8 per 100,000 in males and 3.1 per 100,000 in females.[3] Primary brain tumours constitutes about 1.6% of all tumours diagnosed in the UK. It has been estimated that the lifetime risk of developing brain and other CNS tumour is 1 in 133 for men and 1 in 185 for women in the UK. The incidence of brain and CNS tumours in the UK in 2007 was 6.8 per 100,000.[4] CNS tumours accounts for less than 2% of all primary tumours in Pakistan.[5] These tumours often result in mental debilitation, neurologic deficits, psychological trauma. An understanding of the epidemiology is needed to facilitate prevention, early detection and treatment of CNS tumours. CNS tumours registries have been established and maintained in several countries, and their descriptive epidemiologies have been reported.[6,7] However, there is no accurate nationwide CNS tumour epidemiology in Pakistan that makes policy making for tumour screening and early treatment difficult. The purpose of this study was to provide the spectrum of CNS tumours in a premier diagnostic and referral centre of Pakistan.

MATERIAL AND METHODS

This cross-sectional study was conducted at the Histopathology Department of Armed Forces Institute of Pathology (AFIP), Rawalpindi. Record of computerized histopathology laboratory reports were retrieved from the laboratory information management software (LIMS) from 1st Jan 2008 to 31st Dec 2013. Ethical approval was granted by ethical committee of AFIP Rawalpindi. The sampling technique was non probability consecutive sampling. The cases included in the study were patients who were diagnosed with CNS tumours on histopathology, both benign and malignant, belonging to both genders, between the ages of 1–85 years. All improperly fixed samples and recurrent tumours were excluded. The other CNS diseases including pituitary adenoma, arteriovenous malformation, cysts, abscesses and parasites were not included. A total of seven hundred and sixty one cases fulfilled the inclusion criteria. We reviewed all the

histopathology reports of the cases in the study, while Haematoxylin & Eosin (H&E) slides of random cases were also reviewed. Histo-pathological diagnosis, tumour grade, tumour site, age and gender of the patients were noted. All the CNS tumours were divided into seven categories according to World Health Organization (WHO) grading system for CNS neoplasms, i.e., tumours of neuroepithelial tissue; tumours of the cranial and paraspinal nerves; tumours of the meninges; lymphomas and hematopoietic neoplasms; germ cell tumours; tumours of the sellar region; and metastatic tumours. This data was then analysed on SPSS-20.

RESULTS

Patient's ages ranged from 1 year to 85 years with a mean age of 40.1%. Most patients belonged to 5th decade, followed by 3rd and 4th decades of life. Out of 761 cases 470 (61.8%) patients were males while 291 (38.2%) were females. However in meningeal tumours, females outnumbered males. Figure-1

Seven CNS tumour categories were as follows; tumours of neuroepithelial tissue (56.0%), tumours of the meninges (28.3%), tumour of the sellar region (2.6%), germ cell tumour (0.1%), tumour of cranial and paraspinal nerves (5.4%), lymphomas and haematopoietic neoplasm (2.4%), metastatic tumours (4.9%), where histological types by age and gender showed great variability. Figure-2. Astrocytic tumours were the commonest neuroepithelial tumours (69.4%) with glioblastoma forming the largest subtype of neuroepithelial tumours (40.4%) with a mean age at diagnosis being 47 years.

The detailed spectrum of CNS tumours noted in our study are summarized in Table-1, 2, 3.

Table-1: Main features of neuroepithelial tumours in the series (n=426)

Tumour type	Tumour Grade	No.	Percentage	Age Range (in year)	Mean Age (in Year)	M	F	M:F Ratio	Predominent Site
Pilocytic astrocytoma	I	21	4.9	2–33	17	13	8	1.6:1	Posterior fossa
Diffuse astrocytoma	II	76	17.8	8–68	37.4	64	12	5.3:1	Parietal and frontal lobe
Anaplastic astrocytoma	III	24	5.6	10–70	39.1	19	5	3.8:1	Frontal and parietal lobe
Glioblastoma Multiforme	IV	172	40.4	5–80	47.1	126	46	2.7:1	Frontal, Parietal and temporal lobe
Gliosarcoma	IV	3	0.7	50–65	57.6	2	1	2:1	Frontal parietal and temporal lobe
Pilomyxoid astrocytoma	II	1	0.2	-	28	1	-	-	Posterior fossa
Pleomorphic xanthoastrocytoma	II	2	0.5	17–18	17.5	1	1	1:1	Temporal lobe
Astroblastoma		1	0.2	-	24	1	-	-	Frontal lobe
Oligodendroglioma	II	38	8.9	10–68	37.6	25	13	1.9:1	Frontal, temporal and parietal lobe
Anaplastic oligodendroglioma	III	6	1.4	22–52	34.8	4	2	2:1	Frontal parietal and temporal lobe
Mixed oligoastrocytoma	II	8	1.9	22–73	44.1	6	2	3:1	Parietal and frontal lobe
Anaplastic oligoastrocytoma	III	4	0.9	40–70	50.5	4	-	-	Frontal lobe
Ependymoma	II	13	3.1	6–52	24.1	10	3	3.3:1	Posterior fossa
Myxopapillary ependymoma	I	3	0.7	37–45	40	3	0	-	Cauda equina
Anaplastic ependymoma	III	10	2.3	4–75	29.2	7	3	2.3:1	Parietal, frontal and temporal lobe
Subependymoma	I	1	0.2	-	40	-	1	-	Cerebral hemisphere
Medulloblastoma	IV	28	6.6	1–62	15.3	23	5	4.6:1	Posterior fossa
PNET	IV	10	2.3	5–45	14.9	7	3	2.3:1	Parietal and frontal lobe
Cerebral Neurocytoma	II	2	0.5	24–42	33	2	-	-	Frontal and parietal lobe
Neuroblastoma	IV	3	0.7	18–60	32	3	-	-	Cerebral hemisphere

Table-2: Main features of meningeal tumours in the series (n=216)

Tumour type	Tumour grade	No	Percentage	Age range (in years)	Mean age (in years)	M	F	Sex ratio	Predominent site
Meningioma	I	182	84.3	2–85	44.6	51	131	1:2.6	Parietal and frontal lobe
Atypical meningioma and other types	II	21	9.7	16–70	45.7	10	8	1.25:1	Frontal lobe
Anaplastic meningioma and other types	III	9	4.2	23–67	45.4	7	2	3.5:1	Frontal lobe
Other tumours:									
Haemangioblastoma	I	2	0.9	14–24	19	2	-	-	Cerebellum
Chordoma	-	2	0.9	30–60	45	1	1	1:1	Spinal cord

Table-3: Main features of metastatic tumours, lymphomas and haematopoeitic neoplasms, tumours of cranial and paraspinal nerves and tumours of sellar region (n=119)

Tumour type	No	Percentage	Age range (yrs)	Mean age (yrs)	M	F	Sex Ratio	Predominent site
Metastatic tumours	37	31.1	21–75	49.7	28	12	2.3:1	Parietal frontal and temporal lobes
Lymphomas and haematopoeitic neoplasm	18	15.1	2–80	40.7	11	6	1.8:1	Frontal parietal and occipital lobes
Tumours of cranial and paraspinal nerves	41	34.5	16–63	38.7	26	15	1.7:1	CP Angle, Spinal cord
Tumours of sellar region	20	16.8	5–50	21.7	11	9	1.2:1	Sellar and suprasellar region
Germ cell Tumours	1	0.8	-	22	1	-	-	Suprasellar region

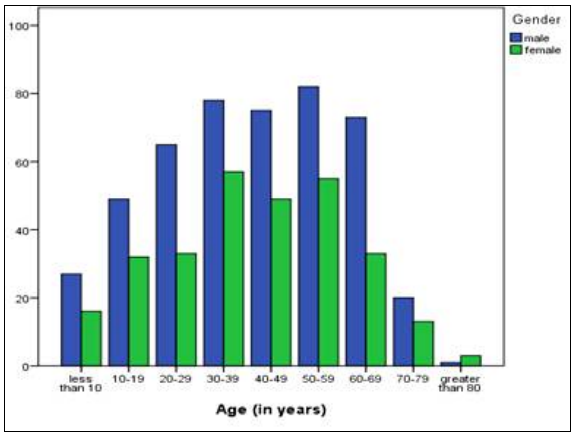

Figure 1: Distribution of CNS tumours by age and sex

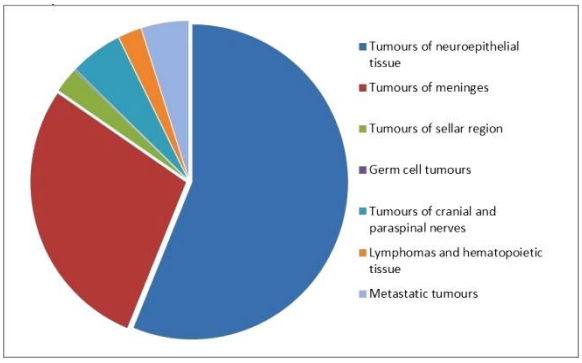

Figure 2: Distribution of Main histological types of CNS tumours

DISCUSSION

The tumour spectrum varied from males to females as well as from children to adults. The study showed male predominance in CNS tumours forming 61.8% of all the cases which is in concordance to some other studies across the country.[8,9] However in meningeal tumours females exceeded male patients, same seen in other local and international studies.[9,10] Patients ages ranged from 1 year to 85 years with a mean age of 40.1%. Most patients belonged to 5th decade, followed by 3rd and 4th decades of life, a similar age distribution is seen in other local studies.[8] For neuroepithelial tumours the male to female was 3.05 as compared to 1.47 in a large study in China[10] and 1.25 from CBTRUS (Central Brain Tumor Registry of the United States) (2003–2007)[11]. Hence this study and other studies[12–14] have shown that there is a higher incidence of CNS tumours in males. The significantly higher of ratio of these tumours in males in our study is striking, which may be lack of standard treatment options and approach to diagnostic modalities towards female population. This higher incidence of neuroepithelial tumour in men may be considered an important research point that could lead to valuable conclusions in relation to tumour origins and treatment modalities. In our series neuroepithelial tumours forms the predominant type accounting for 56.0% of all tumours. Glioblastoma multiforme is forming the largest subtype of astrocytic tumours (40.4%) with a mean age at diagnosis being 47 years. This younger age at presentation is in contrast to what is seen in international literature, where mean age at diagnosis is 64 years.[15] The second most common group being meningeal tumours forming 28.3% of the tumours in the series. Meningioma grade 1 comprises of 84.3% of all the tumours of meningeal series. It is also the single most common type of neoplasm in the study (23.9%), while glioblastoma multiforme comes next (22.6%).

However the distribution of tumour types in our shows little difference with the other studies published worldwide. In our study neuroepithelial tumours and meningeal tumours were the frequent types with the proportion of 56.0% and 28.3% respectively. A single centre study in China revealed this proportion were 38.0% and 36.5% for these two main types,[10] whereas population based record from CBTRUS[11] showed 33.7% and 35.5% respectively. In contrast a Korean study (Lee CH *et al*)[16] showed meningeal tumour to be the most predominant type with 31.2% of all the tumours in the series. The reason for this great variations remains a question and needs further investigations. Table-3

In our study most common malignant tumours in adults are glioblastoma multiforme, followed by metastatic tumours and anaplastic astrocytomas, while in children and teen agers medulloblastoma, glioblastoma and anaplastic astrocytoma are the frequent types. According to CBTRUS data, glioblastoma and anaplastic astrocytoma were the most common malignant tumours in adults forming 17.7% and 2.1% of all the cases.

Regarding paediatric cases, central nervous system tumours have been reported to be second most common cancer (6.3%) in a study conducted at AFIP, Rwp, Pakistan.[17] High frequency of astrocytic (28.2%) and medulloblastomas (207%) and glioblastoma (17.2%) are found in our study paediatric group (1–15 years). These percentages slightly differ from with other studies conducted in Asia and Europe. Table-5 this epidemiological variability may be indicative of environmental and racial factors.

As this study is a single centre series, the data in this study may not represent the national epidemiology of central nervous system tumours. The pathological diagnoses included are from patients who underwent surgical interventions. Other cases with limited access to standard treatment and inoperable cases, who have not undergone surgery are missing in our study. It was not a large population based study and a selection bias invariably exits, but this study may help in monitoring disease patterns and changing trends. The data from this study may provide valuable information regarding CNS tumours spectrum for future research and planning.

Table-4: Comparison of main histological types in various studies

Country	Author	Neuroepithelial tumours	Meningeal tumours	Tumours of sellar region	Germ cell tumour	Tumours of cranial and paraspinal nerves	Lymphomas and hematopoietic neoplasm	Metastatic tumours
Pakistan	Our study	56.0%	28.3%	2.6%	0.1%	5.4%	2.4%	4.9%
China	Chen *et al*[11]	38.0%	36.5%	4.1%	1.3%	13.3%	1.7%	5.1%
Korea	Lee CH *et al*[15]	19.4%	31.2%	15.8%	1.8%	1.8%	1.8%	-

Table-5: Proportion of most common CNS tumours among children and teenager in different regions

Country	Author	Period	Age (yrs)	Astrocytoma	Medulloblastoma	Craniopharyngioma	Ependymal tumours
Pakistan		2008–2013	0–15	22.8%	20.7%	6.9%	6.8%
India	Asirvatham *et al*[18]	1990–2004	0–18	49.7%	12.0%	10.3%	5.2%
China	Chen L. *et al*[10]	1990–2009	0–19	29.2%	13.1%	12.3%	6.2%
Taipei	Wong *et al*[19]	1975–2004	0–18	36.9%	15.8%	9.8%	6.8%
Japan	Makino *et al*[20]	1989–2008	0–15	38.6%	13.1%	13.7%	5.2%
France	Bauchet *et al*[21]	2004–2006	0–19	32.9%	13.1%	5.4%	8.6%
Brazil	Pinho *et al*[22]	1989	0–19	37.7%	16.3%	12.5%	8.1%
US	CBTRUS[11]	2004–2007	0–21	33.1%	12.0%	3.6%	6.7%

CONCLUSION

Neuroepithelial tumours are commonest tumours and comprise more than half of all operated CNS tumours in our setup, followed by meningeal tumours. Glioblastoma multiforme is largest subtype of neuroepithelial tumour, and comprising 40.4% of all. This study can help in observing CNS tumour trends and changing patterns.

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Address for Correspondence:

Maj. Javaria Ahsan, Department of Histopathology, Armed Forces Institute of Pathology, Rawalpindi-Pakistan
Email: javariaahsan75@yahoo.com