ORIGINAL ARTICLE

DISTRIBUTION PATTERN OF BRAIN TUMOUR IN A TERTIARY HOSPITAL IN EAST COAST, MALAYSIA

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ABSTRACT

Brain tumour occurrence in Malaysia demonstrates an increasing trend from year to year among adults and the second most common cancer among children. Thus, the expansion of numerous research for novel therapy and treatment are necessary. The distribution of brain tumour in a specific population is important to provide substantial information about the current trends for developing new diagnostic technique and research. Consequently, this study is opted to provide descriptive data of brain tumour in Hospital Universiti Sains Malaysia (USM). 217 brain tumour cases were collected from the hospital record between 2011 and 2014. The brain tumour cases were confirmed by pathologists according to WHO classification and grading. Descriptive analysis was evaluated by using Microsoft Excel and IBM SPSS version 22. Gender preponderance in this study shows very little difference. The most common adult primary brain tumour in this study was meningioma (32.7%) followed by glioblastoma (7.8%), a type of diffuse astrocytic tumour. According to age factor, brain tumour distribution pattern shows an increasing trend as the age increases and meningioma is the most common among the elder patients. Secondary tumour takes more than 10% from overall percentage of brain tumour cases. In conclusion, the descriptive data presentation in this study is very helpful to provide baseline information on the current brain tumour occurrence in this region.

Keywords- *Brain tumor; descriptive epidemiology; WHO classification; Hospital USM*

INTRODUCTION

Brain tumours in Malaysia are still considered as an uncommon cancer in comparison to other types of cancer. They were reported as representing 1.95% of all malignancies in Malaysia. However, brain tumours are the most vivid form of human diseases, and the most promptly fatal type of cancers[1]. Location of tumour in the brain and their susceptibility to malignant transformation cause even benign tumours lead to fatal consequence[2].

Lim predicted that the incidence of cancer in the elders will be increasing by years especially in the people at 60 years and above. In 1957, the incidence in these age group was 4.6% which increased to 5.7% in 1990 and is estimated to be 9.8% in 2020[3]. Cancer related to brain and spinal cord was among the most common solid childhood cancer in Malaysia.

Brain tumours have been classified by World Health Organization (WHO) based on their microscopic resemblance with putative cells of origin and their recognized levels of differentiation[4]. However, 2016 World Health Organization (WHO) Classification of Tumours of Central Nervous System, the latest brain tumour classification guidelines presents major differences than previous 2007 WHO Classification of Tumours of Central Nervous System by integrating molecular basis into brain tumour diagnosis[5]. The present study implanted the latest 2016 WHO classification system as this is the latest system established by WHO.

The distribution of brain tumours in a specific population is important to provide substantial information about the current trends which then creating obligation for new diagnostic technique and research in our region. Thus, the objective of this study is to describe the distribution of primary brain tumour and secondary brain tumour according to gender, brain tumor types, and age in Hospital Universiti Sains Malaysia.

MATERIALS AND METHODS

Study design and location

This was a retrospective study of primary and secondary brain tumour occurrence and its distribution pattern in an institution located at North East Malaysia (Kelantan). This study was taken place at Department of Pathology, Hospital Universiti Sains Malaysia (HUSM), Kubang Kerian which is a tertiary hospital in the state of Kelantan. It has become an established neurosurgery referral centre for brain and spinal cord injuries especially from secondary hospitals in Kelantan and Terengganu.

Data Collection and Analysis

All 217 brain tumour cases were selected from 2011 to 2014 with exclusion of recurrent brain tumour cases. The brain tumour cases were confirmed by pathologists according to 2016 WHO classification and grading[6]. Screening process to select cases was done by searching in written reports from Pathology Department and examine the Haematoxylin and Eosin staining (H&E) slides and immunohistochemical (IHC) staining slides by using microscope.

Ethical Consideration

This study was supported ethically by National Medical Research Register (NMRR) (NMRR-15-1601-24024(IIR)) and approved by the Research Review Board and Human Research Ethics Committee of Universiti Sains Malaysia, Kelantan, Malaysia (JEPeM Code: USM/JEPeM/16030095).

Socio-demographic variables

Socio-demographic variables extracted from this study were age group and gender.

Statistical Analysis

Descriptive analysis was evaluated by using Microsoft Excel and IBM SPSS version 22.

RESULTS

A total of 217 newly diagnosed cases of various brain tumour types were reported from 2011 to 2014 in HUSM. From the total number of patients, 100 patients were male and the remaining 117 patients were female.

There were 10 histological types of primary brain tumour included in this study according to WHO classification and secondary tumour. The primary brain tumours included diffuse astrocytic and oligodendroglial tumour, other astrocytic tumours, ependymal tumours, neuronal and mixed neuronal-glial tumours, pineal tumour, embryonal tumour, tumours of the cranial and peripheral nerves, meningeal tumour, mesenchymal tumour and tumour of the sellar region.

Pie chart in Figure 1 illustrates the distribution of major histological types of brain tumour. The most common brain tumour were meningeal tumors with 78 cases of 217 overall cases (36.4%). The second commonest major types of brain tumours were diffuse astrocytic and oligodendroglial tumours which recorded 40 cases or 18.4 %. 28 cases (12.9 %) of secondary tumours resulted the third most common brain tumour in this hospital followed by cranial and peripheral nerves tumours (10.1 %), embryonal tumours (6.9 %), ependymal tumours (5.1 %), other astrocytic tumours (4.1 %), mesenchymal tumours (3.2 %) and tumour of the sellar region (1.8 %). Finally, neuronal and mixed neuronal-glial tumours and pineal tumours categories both owned only one cases making them the most uncommon brain tumours in this hospital.

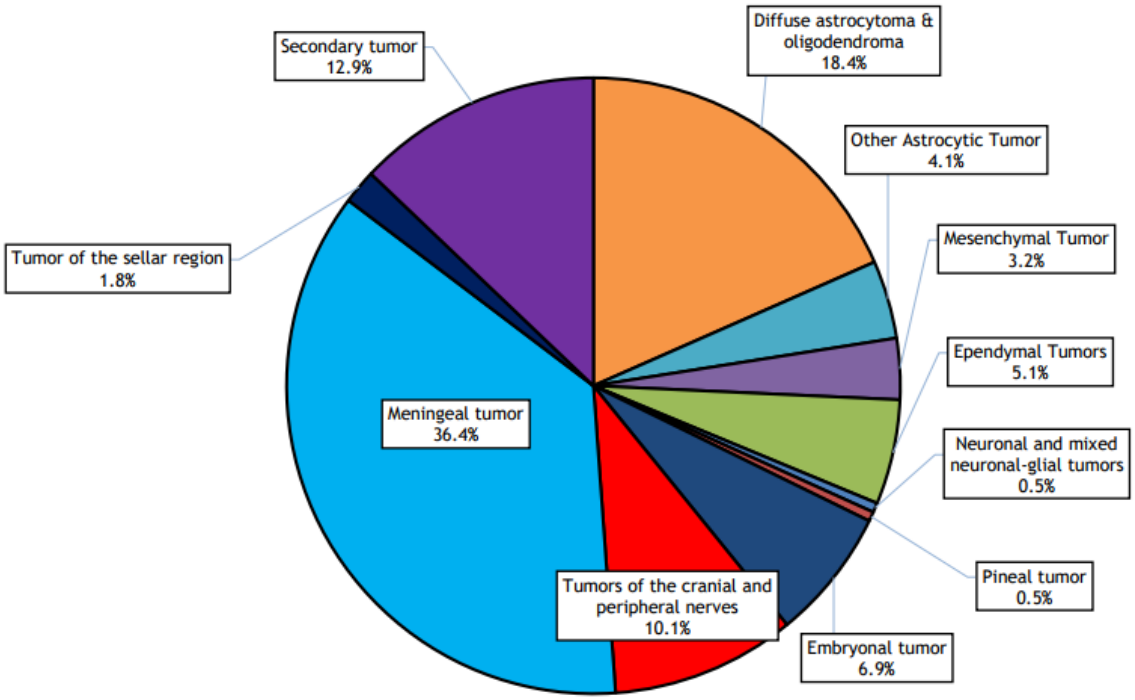

Figure 1: Distribution of major histological types of brain tumour.

Table 1 shows detailed distribution of brain tumours according to the specific histological types. According to the table, the most frequent brain tumour which was meningiomas group consists of meningioma, atypical meningioma and anaplastic meningioma subtypes. 71 out of 78 cases of this tumour belong to meningioma with percentage of 32.7 % from overall brain tumour cases in this study, thus making it the most usual adult brain tumour among all. Six cases reported for atypical meningioma and only one case reported for malignant or anaplastic meningioma.

As the second most frequent brain tumour, glioblastoma was the most common tumours among other subtypes in this diffuse astrocytoma and oligodendroma tumours group. 17 cases out of 40 cases reported for glioblastoma, a high grade glioma, followed by anaplastic astrocytoma with 11 cases and diffuse astrocytoma with 6 cases. Oligodendroglioma and anaplastic oligodendroma showed only one and two cases respectively while anaplastic oligoastrocytoma reported only one case out of 40 cases in its major group.

The frequency of brain tumour types according to gender was tabulated in Table 2. In this study, as overall, females displayed slightly higher number of cases than males. Females reported 117 cases over 100 cases in males. The most common brain tumour type in this study, meningeal tumour, indicates 61.5% females than 38.5% males. In contrary, the second most common major brain tumour type, diffuse astrocytoma and oligodendroglioma exhibits higher percentage in males (57.5%) than females (42.5%).

According to Table 3, the age was grouped into three categories which were below 15 years, 16 to 44 years and 45 years and above to represent young age, medium and elders respectively. The elders group recorded the highest cases of 107 from 215 cases followed by the medium group with 77 cases and children below 15 years old with 31 cases. This data shows that there was an increasing trend of brain tumour occurrence according to age within this study period.

Table 1: Detailed histological types of brain tumour (n=217)

Histological types of brain tumour	Number of cases	Percentage (%)
Diffuse Astrocytoma & Oligodendroma tumours		
Diffuse Astrocytoma	6	2.8
Anaplastic Astrocytoma	11	5.1
Glioblastoma	*17*	*7.8*
Giant cell glioblastoma	1	0.5
Gliosarcoma	1	0.5
Oligodendroglioma	1	0.5
Anaplastic Oligodendroglioma	2	0.9
Anaplastic Oligoastocytoma	1	0.5
Other astrocytic tumors		
Pilocytic Astrocytoma	8	3.7
Pleomorphic Xantroastrocytoma	1	0.5
Ependymal Tumours		
Ependymoma	6	2.8
Anaplastic Ependymoma	5	2.3
Neuronal and mixed neuronal-glial tumours		
Central Neurocytoma	1	0.5
Pineal tumour		
Pineocytoma	1	0.5
Embryonal tumour		
Medulloblastoma	14	6.5
Tumours of the cranial and peripheral nerves		
Schwannoma	10	4.6
Neurofibroma	5	2.3
MPNST	7	3.2
Meningeal tumour		
Meningioma	*71*	*32.7*
Atypical Meningioma	6	2.8
Anaplastic meningioma	1	0.5
Mesenchymal, non-menigiothelial		
PNET	5	2.3
Hemangiopericytoma	2	0.9
Hemangioblastoma	2	0.9
Tumour of the sellar region		
Craniopharingioma	4	1.8
Secondary Tumour	*28*	*12.9*
Total	217	100.0

Descriptive Statistics: Frequency

In elders group, meningiomas was the most frequent brain tumour with 50 out of 107 cases. Secondary or metastatic tumours accounted 10.7 % of this age group. Diffuse astrocytoma & oligodendroglioma tumours recorded the third highest percentage of cases with 17 cases (7.9 %). Cranial & peripheral nerves tumours, ependymal tumours and mesenchymal or non-meningothelial tumours recorded lower than 3.3 % from overall percentage of adult brain tumours.

Meningiomas are also the most common brain tumours in medium age group with slightly more than half percentage than meningiomas in elder group (13 %). Diffuse astrocytoma and oligodendroglioma tumours recorded the second highest percentage of 8.8 % in this age group and followed by cranial and peripheral nerves tumours with 6.0 %. Other brain tumour cases recorded less than 5 cases and there was no cases reported for mesenchymal or non-meningiothelial tumours cases.

Table 2: Distribution of brain tumour according to histological types and gender

Histological types	Gender		Total
	Male	Female	
Diffuse Astrocytoma & Oligodendroma tumours	23 (57.5%)	17 (42.5%)	40
Other astrocytic tumours	3 (33.3%)	6 (66.7%)	9
Ependymal tumours	4 (36.4%)	7 (63.6%)	11
Neuronal and mixed neuronal-glial tumours	1 (100.0%)	0 (0%)	1
Pineal tumour	0 (0.0%)	1 (100.0%)	1
Embryonal tumour	10 (71.4%)	4 (28.6%)	14
Tumours of the cranial and peripheral nerves	9 (40.9%)	13 (59.1%)	22
Meningeal tumour	30 (38.5%)	48 (61.5%)	78
Mesenchymal or non-meningothelial tumours	6 (66.7%)	3 (33.3%)	9
Tumour of the sellar region	2 (50.0%)	2 (50.0%)	4
Secondary tumour	12 (42.9%)	16 (57.1%)	28
Total	100 (46.1%)	117 (53.9%)	217 **(100%)**

Descriptive Statistics: Crosstabulation

Table 3: Distribution of brain tumour according histological types and age group (n=215 with 2 missing value)

Histological types	Number of cases (%)	Age group		
		<15 years	16-44 years	>45 years
Diffuse Astrocytoma & Oligodendroma tumours	39 (18.1%)	3 (1.4%)	19 (8.8%)	17 (7.9%)
Other astrocytic tumours	9 (4.2%)	6 (2.8%)	2 (0.9%)	1 (0.5%)
Ependymal tumours	12 (5.6%)	2 (0.9%)	4 (1.9%)	6 (2.8%)
Neuronal and mixed neuronal-glial tumours	1 (0.5%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Pineal tumour	1 (0.5%)	0 (0.0%)	1 (0.5%)	0 (0.0%)
Embryonal tumour	15 (7.0%)	13 (6.0%)	2 (0.9%)	0 (0.0%)
Tumours of the cranial and peripheral nerves	21 (9.8%)	1 (0.5%)	13 (6.0%)	7 (3.3%)
Meningeal tumour	78 (36.3%)	0 (0.0%)	28 (13.0%)	50 (23.3%)
Mesenchymal or non-meningothelial tumours	7 (3.3%)	4 (1.9%)	0 (0.0%)	3 (1.4%)
Tumour of the sellar region	4 (1.9%)	2 (0.9%)	2 (0.9%)	0 (0.0%)
Secondary tumour	28 (13.0%)	0 (0.0%)	5 (2.3%)	23 (10.7%)
Total	215 (100%)	31 (14.4%)	77 (35.8%)	107 (49.8%)

Descriptive Statistics: Frequency

The most frequent childhood brain tumour (age below than 15 years old) in this study was medulloblastoma of embryonal tumours with 13 cases (6.0 %). Pilocytic astrocytoma which is low grade glioma was the second commonest brain tumour among childhood reported with 2.8 % from overall cases and followed by mesenchymal tumours, diffuse astrocytoma, ependymal tumours, tumours or sellar region and peripheral nerves tumours which accounted for less than 4 cases of brain tumours. No cases reported for meningiomas, secondary brain tumours, neuronal and mixed neuronal-glial tumours and pineal tumours.

DISCUSSION & CONCLUSION

The Department of Neurosciences Hospital USM, Kelantan was established on 17 August 2000 and it becomes as the referral centre for east coast region especially Kelantan and Terengganu. This epidemiology study was done to provide current status of brain tumour incidence in the respective region descriptively hence the pattern can be monitored.

Brain tumour incidence in developed countries ranged from 10 to 19.89 per 100,000 population per year[7-9]. In our country, National Cancer Registry (2003-2005) stated that the crude incidence of brain and other nervous system tumours in Peninsular Malaysia was 2.7 for male and 2.2 for female per 100,000 population per year[10]. Goh et al. reported incidence of calculated brain tumour only in Sarawak was 3.7 per 100,000 population per year in 2009 and it had gradually increased to 4.6 per 100,000 population per year in 2012[2]. According to Yusoff et al., the incidence of brain tumour among Kelantan and Terengganu in 1996 was 0.44 per 100,000 population per year (1998).

The slight differences of incidence among different continents or regions may be affected by various factors such as different research study methodologies, poor health education in that particular region and low economic status[1]. Besides, the advancement of technology involved in examination and detection of brain tumours also affected the factors causing the increased in the incidence[2]. Brain tumour incidence was not determined in this study, however, the information provided is helpful to presume the brain tumour distribution in this region.

In this study, females display higher incidence of brain tumour than male. This finding was parallel with the study done in Sarawak in 2014[2]. Central Brain Tumour Registry of the United States (CBTRUS) data exhibited a more than two-fold higher age-adjusted incidence rate among females of 8.36 and 3.61 for females and males, respectively[8]. However, there were other studies reporting that brain tumour in males were more greater in number than females[1,11]. Meningioma, the most frequent brain tumour in this study recorded higher preponderance in females than males which was corresponding to many other previous studies done[1,2,9,12]. There were few hypothetical reasons that aroused due to the significance gender preponderance in meningioma such as higher incidence of females than males of post-pubertal disease, meningioma with hormone receptor on them, breast cancer and meningioma association, the response of meningioma during menstrual cycle and pregnancy and the function of estrogen agonist therapy that could seized multiple meningioma from growing[12-14]. According to Wiemels et al., meningioma and breast cancer share the same risk factors such as gender, age, hormone induction, and possibly other demographic variables[12].

The second commonest brain tumour in this study, gliomas however showed higher preponderance in males than females. This finding was also supported by other previous studies[1,7]. Glioblastoma which was the most frequent gliomas in this study too had higher preponderance in males compared to females.

In paediatric cancer, paediatric brain tumours were the second most frequent after hematological malignancies and the most common within solid tumours. Paediatric brain tumours have risen to almost half the percentage from only 20% throughout the years 1975 to 2000[15]. In Malaysia, brain tumour is the third most frequent pediatric cancer after leukaemia and lymphoma[10]. It was stated that, the increase in incidence was resulting from the improvement of diagnostic appliances and increasing concernment in cancer information[15,16]. Medulloblastoma and pilocytic astrocytoma were the most and second commonest brain tumour in this study. This finding was comparable with many other previous studies[2,9,15,16]. Medulloblastoma cases have shown significance gender preponderance with males predomination. It was suggested that the rare gender ratio may represent genetic phenomenon [17,18]. Furthermore, the immunological condition of the mother was suggested as perfect environment for male foetus to induce tumourigenesis[16].

There was increasing trends of incidence of brain tumour with increasing age. Many previous findings exhibited that the pattern increased from early age and then decreased in the very old patients[1,2,11,19]. Yusoff et al. suggested that the decreased might be due to less elderly patients that meet the doctors with brain tumour signs and

symptoms[1]. Nevertheless, after a decade, health education among elder patients should have been increased and the establishment of neurology centre helped the patients to easily access the information resulting in higher incidence nowadays.

Secondary tumour took more than 10% from overall percentage of brain tumour cases in this study. Brain metastases were detected to be predominant in older patients 45 years old and above. Majority of the cases are metastasis from an unknown primary tumour and only a few are secondarised from lung, kidney, breast, thyroid gland and liver.
In conclusion, meningioma, a meningeal tumour is the commonest adult brain tumour followed by glioblastoma, an astrocytic tumour. Paediatric brain tumour is predominated by medulloblastoma while low grade glioma was the second commonest paediatric brain tumour. Incidence of brain tumour by gender overall has only a slight difference in this study. However, in meningiomas, females exhibited higher preponderance than males. In contrary, males are outnumbered the females in glioblastoma. Medulloblastoma in paediatrics shows higher number in males than females. According to age, brain tumours distribution pattern shows increasing trends as the age increases and meningioma are the most common among the elder patients. Secondary tumour took more than 10% from overall percentage of brain tumour cases. Elder patients are the majority group suffer from this type of tumour. This study provides the descriptive distribution of brain tumour in Kelantan and Terengganu which facilitate in displaying current epidemiologic status of the disease in this region.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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