

RESEARCH COMMUNICATION

A Retrospective Study of Primary Brain Tumors in Children under 14 Years of Age at PIMS, Islamabad

Saima Nasir^{1*}, Bibi Jamila¹, Samina Khaleeq²

Abstract

The aim of present study was to determine the relative frequency of primary brain tumors among children under 14 years of age in Pakistan. A retrospective review of pediatric primary brain tumors, encountered over 13 years (January 1998 through July 2010) at the Neurosurgical Unit of the Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan, was made covering 231 cases, 142 (61.5%) males and 89 (38.5%) females, with a male to female ratio of 1.69:1. The cases were divided into 5 age groups each covering three years of life (0-2, 3-5, 6-8, 9-11 and 12-14 years), with the greatest number in age group 3 i.e. 6-8 years (32%) and the least number of patients in age groups 1 and 5 (10.3% each). The 231 malignancies were categorized by site into two groups, supratentorial (83 cases; 35.9%) and infratentorial (148 cases; 64.1%). The morphological distribution was medulloblastoma (33.3%), astrocytoma (24.7%), mixed gliomas (14.7%), craniopharyngioma (11.7%), ependymoma (8.7%), PNET (6.1%) and pineal tumor (0.9%). Since only a single institution was studied, cautious interpretation is needed. Ideally, a population-based approach would be adopted to determine the cancer burden due to pediatric malignancies of the brain in this population and for their morphological categorization in Pakistan.

Keywords: Primary brain tumors - supratentorial - infratentorial - medulloblastoma - Pakistan

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Introduction

Childhood tumors are a biologically different entity from tumors of adult and later life. Brain tumors in infancy and childhood differ in topographical distribution, biological behavior, clinical and therapeutic aspects, prognosis and outcome from those that present in later life (Giuffre, 1989). Primary malignant brain tumors account for 2% of all cancers in children (Greenwald et al., 1983). They are the leading cause of cancer death among children and the second most common type of pediatric cancer after leukemia (Baldwin et al., 2004). The overall age pattern of brain tumors includes a peak incidence below five years of age, which declines gradually till the age of 20 years. The age pattern varies by tumor type (Velema and Percy, 1987). Primary brain tumors are commonly located in the posterior cranial fossa in children and approximately 70% of all intracranial tumors in children are infratentorial (Young et al., 2000). Eighty-eight percent of all tumors fall into one of the 4 categories, astrocytoma, medulloblastoma, ependymoma and craniopharyngioma (Cohen et al., 2001).

Although exact incidence rate cannot be provided by a hospital based study, the information is useful in showing patterns of childhood primary brain tumors in our region. To determine the rates following the same

pattern described in Western and far Eastern countries, we analyzed the data compiled from patients with brain tumors operated in Neurosurgical Unit of PIMS, Islamabad, Pakistan from 1998-2010. The objective was to determine the morphological pattern of primary brain tumors and to determine the frequency distribution of different brain tumors in children below fourteen years of age admitted in PIMS and their demographic status over a period of 13 years. All patients entered into this study had pathologically proven brain tumors.

Materials and Methods

The present study is based on the data collected from the Neurosurgical Unit of PIMS. The histopathology records were retrospectively reviewed for all the children under 14 years of age which were received, diagnosed and operated for primary brain tumors during last 13 years from January 1998 to July 2010. In addition to types and site of the tumor, patient demographics including sex and age were also recorded. To highlight the sex distribution and age frequency amongst each age-group band, the age of the patients was divided in five groups: Group 1 (0-2 years); group 2 (3-5 years); group 3 (6-8 years); group 4 (9-11 years) and group 5 (12-14 years). Data was analyzed using GraphPad Prism 5 for windows.

¹Pakistan Council for Science and Technology, Shahrah-e-Jumhuriat, ²Quaid-e-Azam Postgraduate Medical College, Pakistan Institute of Medical Sciences, Pakistan. *For correspondence : saimanasir2007@yahoo.com

Results

1566 children of ages between 0-14 years had undergone surgery at Neurosurgical Unit of PIMS during the study period. 231 (14.75%) cases out of the total cases were reportedly operated for primary brain tumors. Out of them, 142 (61.47%) were males and 89 (38.52%) were females. Male to female ratio was 1.69:1. The age of the patients was divided in five groups (Table 1). The mean age of patients was 6.73 (± 0.21) years (range, 0.25-14 years). Most of the patients (32%) were in age group 3 and the least number of patients were found in age groups 1 and 5 (10.3% each) as shown in Table 1. A distinct overall male predominance was noted in all tumor types (Table 2).

The malignancies included in this study were categorized by site into two groups; supratentorial 83 (35.9%) and infratentorial 148 (64.1%), the later approximately 2/3rd of the cases in the current study. The mean age of patients for supratentorial tumors was 7.41 (± 0.37) years (range, 0.33-14 years) and the mean

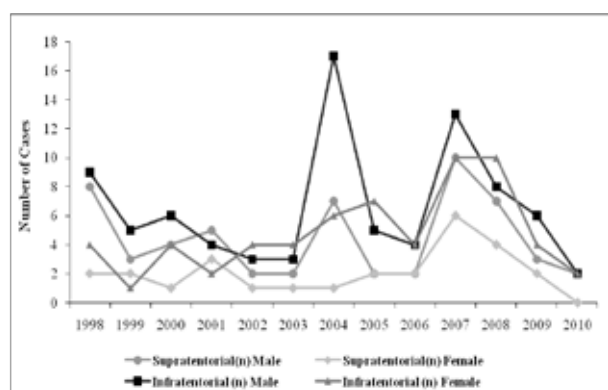


Figure 1. Gender Wise Frequency of Infratentorial and Supratentorial. Tumors in Children

age of patients for infratentorial tumors was 6.34 (± 0.26) years (range, 0.25-14 years). The gender wise frequency distribution of infratentorial and supratentorial tumors over the course of thirteen years is shown in Figure 1.

It is evident that medulloblastoma (33.3%) was the most common group of brain tumors in children (Table 1). The mean age of patients for medulloblastoma was 6.17 (± 0.35) years (range, 0.75-14 years) with most patients (36.3%) in age group 3. Astrocytoma was the second most dominant tumor type in our study (24.7%). The mean age of patients for astrocytoma was 6.68 (± 0.44) years (range, 0.25-14 years) with most patients in age group 2 and 3, each with a frequency of 28.1%. Mixed gliomas were ranked next with a frequency of 14.7% followed by craniopharyngioma (11.7%) and ependymoma (8.7%). Mixed gliomas showed mean age of 7.2 (± 0.61) years (range, 0.75-13.5 years) with most patients (29.4%) in age group 3. The mean age of patients for craniopharyngioma was 6.8 (± 0.68) years (range, 0.33-12 years) with most patients (29.6%) in age group 3 and for ependymoma mean age was 6.87 (± 0.73) years (range, 1-14 years) with most patients (35%) in age group 2. PNET (6.1%) with mean age of 8.3 (± 0.75) years (range, 3-13 years) and pineal tumor (0.86%) with mean age was 8.5 (± 2.5) years (range, 6-11 years) accounted for the least common group of brain tumors in children according to present study.

Discussion

The present study was designed to determine the frequency of Primary Brain Tumors from January 1998 to July 2010 among children under 14 years of age. Our study revealed male preponderance with overall male to female ratio of 1.69:1, which is inline with previous studies (Kadri et al., 2005; Ahmed et al., 2007; Memon

Table 1. Age-wise Distribution of Tumor Cases in Children under 14 Years of Age at PIMS from 1998 to 2010

Age	Medulloblastoma	Astrocytoma	Ependymoma	Glioma	Craniopharyngioma	PNET	Pineal Tumor	Total Cases
<1y-2y	9	6	1	4	4	0	0	24 (10.38%)
3y-5y	25	16	7	8	5	2	0	63 (27.27%)
6y-8y	28	16	6	10	8	5	1	74 (32.03%)
9y-11y	9	13	5	6	7	5	1	46 (19.91%)
12y-14y	6	6	1	6	3	2	0	24 (10.38%)
Total	77 (33.33%)	57 (24.67%)	20 (8.65%)	34 (14.71%)	27 (11.68%)	14 (6.06%)	2(0.86%)	231(100%)

Table 2. Yearly Distributions of Different Primary Brain Tumors by Gender in Children under 14 Years of Age

Year	Medulloblastoma		Astrocytoma		Ependymoma		Glioma		Craniopharyngioma		PNET		Pineal Tumor	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1998	3	1	4	2	3	1	6	1	1	1	0	0	0	0
1999	6	1	0	1	0	0	1	0	1	1	0	0	0	0
2000	1	2	5	2	1	0	2	0	1	0	0	1	0	0
2001	2	0	1	3	2	0	1	2	1	0	2	0	0	0
2002	0	3	2	1	1	0	1	0	0	1	0	0	1	0
2003	1	3	2	1	0	0	1	1	1	0	0	0	0	0
2004	10	4	6	2	1	0	2	1	4	0	1	0	0	0
2005	2	2	1	4	2	1	0	2	2	0	0	0	0	0
2006	3	2	1	1	1	0	0	0	1	1	1	1	0	0
2007	9	6	3	2	2	2	4	2	3	2	2	2	0	0
2008	3	6	4	3	1	1	3	1	3	2	1	1	0	0
2009	4	2	2	2	0	0	1	1	0	0	2	0	0	1
2010	1	0	0	2	1	0	1	0	1	0	0	0	0	0
Total	45	32	31	26	15	5	23	11	19	8	9	5	1	1

et al., 2007; Rehman et al., 2009).

As it is a hospital based study so it is not possible to calculate tumor incidence however the frequency of primary brain tumors in total neurological cases was 14.75%. In previous studies a relatively lower frequency was reported. Grover and Hardas (1972) reported a frequency of 8.2% in Bombay Cancer Registry. Khan et al., (1983) reported 9% frequency of childhood brain tumors at PIMS. It is evident from the available data that the frequency of primary brain tumors in children has increased with the passage of time.

Present study revealed most of the patients in age group 6-8 which is nearly in accordance with a previous study done by Ahmed et al. (2007) who reported most cases in age group 5-9. However Velema and Percy (1987) and Memon et al., (2007) reported most cases in lower age group.

In our study mean age for tumor incidence was 6.73. The mean age was 6 years in a previous study reported by Farwell et al., (1977) while Ahmed et al., (2007) and Mehrzin et al., (2006) reported mean age as 8.8 and 8.7 years respectively which is higher than our study.

The tumor site classification revealed that the frequency of infratentorial tumors (64.1%) was higher than the supratentorial tumors (35.9%). These findings complement most published data on the subject. Some previous studies (Ahmed et al., 2007; Kadri et al., 2005; Khan et al., 2009) reported nearly same results except Pollack (1999) reported higher number of supratentorial tumors (52%) as compared to infratentorial tumors (48%).

Medulloblastoma was the most frequent tumor of our study constituting 33.3% of total cases and is comparable with Young et al., (2000) and Ahmed et al., (2007) where it was the leading tumor type. Zakrzewski et al., (2003) and Memon et al., (2007) reported astrocytoma as the most frequent childhood tumor, while in our study astrocytoma is the second most frequent tumor type. Our study also contradicts with studies done by Mehrazine et al., (2006), Rehman et al., (2009) and Khan et al., (2009) who reported meningioma, neuroma and gliomas as the most dominating types of childhood tumors in their studies respectively. Most of the previous studies (Zakrzewski et al., 2003; Ahmed et al., 2007; Memon et al., 2007) showed approximately the same % age of ependymoma as reported in the present study (8.66%). A comparatively lesser percentage of ependymoma is reported in some studies (Mehrazine et al., 2006; Khan et al., 2009).

The current study is a single institution study and needs cautious interpretation. Population-based studies are required to determine the cancer burden due to pediatric malignancies of the brain in this population and for the morphological categorization of brain tumors in Pakistan.

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