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Original Article

Pediatric Brain Tumors

Pak Armed Forces Med J 2021; 71 (3): 992-95

# FREQUENCY OF PEDIATRIC BRAIN TUMORS IN TERTIARY CARE INSTITUTE OF PAKISTAN AND COMPARISON WITH INTERNATIONAL DATA

**Hassan Tariq, Hiba Tahir*, Hafeez Ud Din, Hamza Mansur, Muhammad Owais Qurni, Maria Aslam**

Armed Forces Institute of Pathology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Federal Medical & Dental College, Islamabad Pakistan

## ABSTRACT

***Objective***: To analyze the histological spectrum of pediatric brain tumors (PBT) in Pakistani population and to compare the results with international data.

***Study Design***: Retrospective observational study.

***Place and Duration of Study***: Armed Forces Institute of Pathology, Rawalpindi, from Jan 2015 and Dec 2019.

***Methodology***: This data was analyzed using the latest World Health Organization (WHO) classification of Tumors of Central Nervous System 2016. The cases were divided in 5 categories according to age (0-2, 3-5, 6-8, 9-11 & 12-14 years).

***Results***: A total of 43 cases were included in the study. Of these cases, 26 (60.46%) were male and 17 (39.5%) were female. Male to female ratio was 1.5-1. The 6-8 year age group had the highest number of tumors while 0-2 year age group had the least. Mean age of diagnosis was 7.6 years. Ependymoma wasthe most common morphological type with 12 cases (28%) followed by pilocytic astrocytoma, diffuse glioma with 10 cases each (23%) and medulloblastoma with 9 cases (21%). Least common tumor subtype was Ewing sarcoma. Ependymoma were mostly of grade 3 (64%), pilocytic astrocytoma and medulloblastoma were of grade 1 and grade 4 respectively by definition, and diffuse gliomas were mainly of grade 2 (57%) type.

***Conclusion***: Ependymoma and pilocytic astrocytomaare the most frequent types of pediatric brain tumors in our region which follows the same trend as mentioned in western and regional literature.

**Keywords**: Brain tumor, Ependymoma, Glioma, Pediatric, Pilocytic astrocytoma.

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## INTRODUCTION

Central nervous system tumors of infancy are the second most common type of pediatric tumors, second only to leukemia[1], making up about 20-25% of all pediatric malignancies[2]. However, they remain to be the major cause oftumor related deaths despite a lot of advances made in the field of neuroscience. These tumors differ from those found in adults in morphological type, site, treatment, prognosis and outcomes[3]. Adult brain tumors mostly develop in the upper region of the brain whereas childhood tumors tend to develop in the posterior cranial fossa. Although childhood brain tumors have a better prognosis and have a better treatment response, but children experience substantial side effects from the treatment[4]. The most common types of pediatric brain tumor, making up 88% of all cases, are astrocytoma, ependymoma, craniophraryngioma and medullob-lastoma[5]. The purpose of this study was to determine the prevalence and frequency of different histological types of childhood brain tumors under the age of 14 years in our region as very scant data is available about thses tumors in our settings.

## METHODOLOGY

Histological data regarding PBTs collected in Armed Forces Institute of Pathology (AFIP), from January 2015 to December 2019, was retrospectively collected from LIMS database. Approval of AFIP ethics committee was taken. The parameters assessed in the study were the morphology of tumor, its grade and patient demographics like age and gender. The data from all the patients, under the age of 14 years were included irrespective of the gender of the patient. Poorly stained slides and cases in which the age group was not mentioned or cases in which there was no consensus on the diagnosis were excluded To give a clearer picture of gender distribution and age frequency, patients were divided into five groups according to age; group 1 included patients between the ages of 0-2 years, group 2 included 3-5 years, group 3 included 6-8 years, group 4 included 9-11 years and group 5 included 12-14 years. Tumors were graded according to the 2016 WHO classification system of tumors of central nervous system. Data was analyzed using SPSS 21. The study was a frequency study so no test of significance was applicable.

## RESULTS

Among the 43 cases, 26 (60.5%) were male and 17 (39.5%) were female. Male to female ratio was 1.52 to 1. Ependymoma was the most common PBT with 12 (28%) (fig-1). Second most prevalent tumors were diffuse glioma and pilocytic astrocytoma, each of which

**Correspondence: Dr Muhammad Owais Qurni,** Resident Histopathology, AFIP Rawalpindi Pakistan

*Received: 14 Oct 2020; revised received: 22 Dec 2020; accepted: 06 Jan 2021*

were 10 (23%) of the patients. Medulloblastoma consisted of 9 (21%) of cases. Least number of cases were of Ewing sarcoma, which made only 2 (5%) of the cases (fig-1). The age group with the highest cases of tumor was 3-5 years with 15 cases, followed by 6-8 years group with 10 cases. Group with the least number of cases was 0-2 years with only 3 cases reported. This age group was exclusively made up of cases of ependymomas (fig-2). The mean age at diagnosis was 7.6 years. In group 3-5 years most prevalent tumor was ependy-moma (fig-2). In group 6-8 years, medullo-blastoma was the most common type of tumor (fig-2). Group 9-11 years had diffuseglioma and astrocytoma as the predominant tumor type (fig-2). In group 12-14 years, medu-

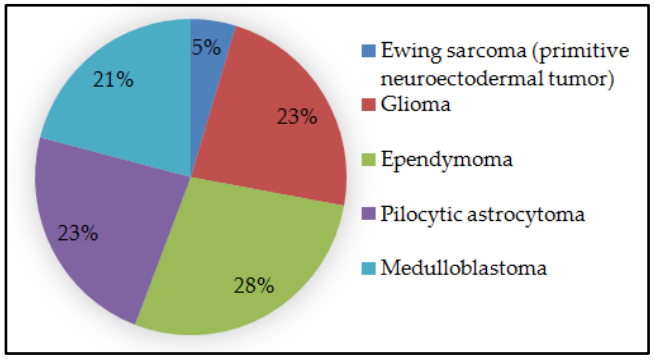


**Figure-1: Overall frequency of different pediatric brain tumors.**

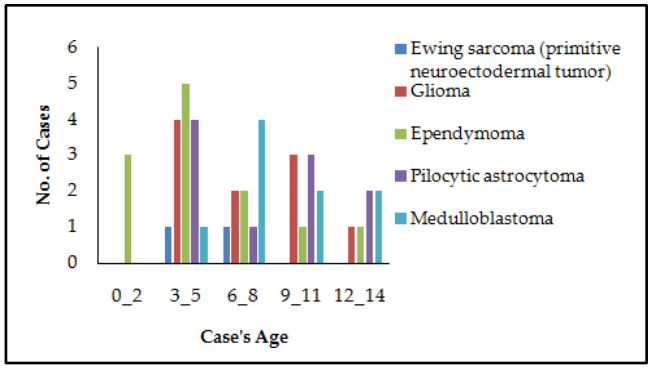


**Figure-2: Age group distribution of pediatric brain tumors.**

lloblastoma and astrocytoma were the prevalent tumors (fig-2). Ependymoma, the most prevalent tumor, was mostly of grade III with 64% of the cases, while grade II made 36% of cases. Pilocyctic astrocytomas, by definition, comprised grade Itumors. All tumors sub categorized as medulloblastoma, by definition were grade IV. Diffuse glioma cases were 57% grade IIand 43% grade IV (fig-3).

## DISCUSSION

The incidence of PBTs is increasing, due to advanced imaging techniques, better histological diagnosis and increased general awareness. Our study revealed a male predominance with a male to female ratio 1.5:1. This is in line with rest of the studies done else where on the subject with the reported ratio ranging from 1.3-2.56[7]. Highest ratio was recorded in Pakistan. According to Rorke and Smut the male preponderance might be due to the gender distribution of the normal population under 14 years of age rather than the actual higher incidence of these tumors in males as compared to females. However, the gender distribution ratio in the normal Pakistani population is 1.6-1 under 14 years of age[6]. This is much lower than ratio of male to females in PBTs as shown by our result. Consequently, there may actually be a higher incidence of PBTs in males as compared to females.

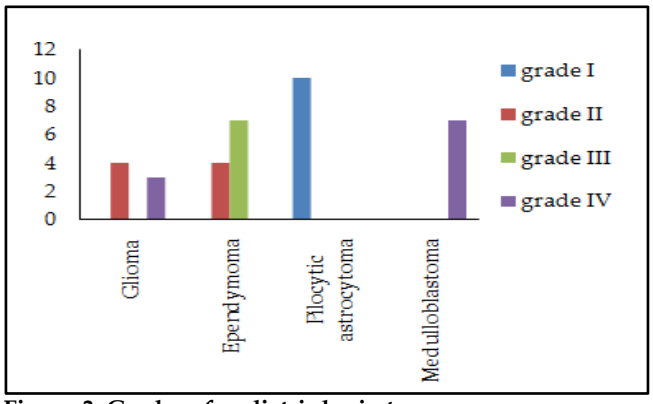


**Figure-3: Grades of pediatric brain tumors.**

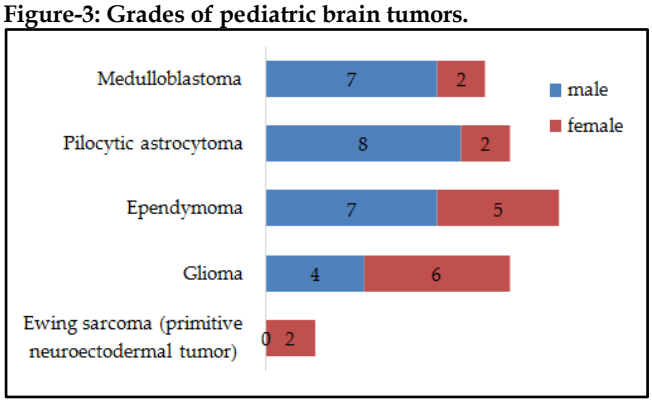


**Figure-4: Gender distribution among pediatric brain tumors.**

A higher frequency of medulloblastoma, pilocytic astrocytoma and ependymoma in males was seen in our study. There is female predominance in cases of diffuse glioma and primitive neuroectodermal tumors /Ewing Sarcoma. This contradicts with Nasir *et al*, findings 4 who reporteda higher number of male cases as compared to female cases amongst all pediatric brain tumors. In most studies carried out in India, there was male predominance in cases of medulloblas-

toma and female predominance in cases of pilocytic astrocytoma, the latter being contrary to our results[10].

Mean age at diagnosis was 7.6 years according to our study, while the mean age according to other regional studies was 6.8. Mean age reported by other studies in Pakistan was 8.8 and 8.7 years by respectively[4]. International studies showed variation in mean age at diagnosis as follows: 10.6 years in India, 9.7 years in Nigeria, 9.3 years in Morocco, 8.8 years in Iran and 12.6 years in China[9,10,11].

A point of major contradiction between our study and the studies done elsewhere on the subject is on the prevalence of morphological subtypes of tumors. According to our data, the most common tumor wase pendymoma, but other national and international data cite medulloblastoma as the most common pediatric brain tumor subtype[12,13].

The subject of the most frequent childhood tumor has been a point of contention among the researchers. This might be due to inconsistencies in defining and classifying these tumors. Another reason for this discrepancy may bedue to difference in the upper age limit for the pediatric tumors. Studies that reported a predominance of medulloblastoma had the upper age limit of 14 while those that set the upper age limit to 20 years showed astrocytoma as the most prevalent tumor[14,15].

Our results show a high number of ependymoma cases while most of the international studies reveal ependymoma as third most common subtype. This includes a meta-analysis done by Rickert *et al*, and same pattern has been observed in other papers[16]. However, some local studies place ependymoma as the fourth most common tumor subtype[17,18].

The reasons for the discrepancy between our results and the data obtained fromother studies might be due to differences in sample size, epidemiology of our region, lack of research in this subject. Another pertinent reason may be due to the delay in reporting of pediatric neurological malignancies due to financial constraints as well as lack of screening facilities in this part of the world of our study. Another reason for low frequency of diffuse glioma in our results might be because we have not included pilocytic astrocytoma in diffuse glioma while the rest of the studies have done so.

## CONCLUSION

This study was based on limited data obtained from a single institution. To get a clear picture of incidence and prevalence of different types of pediatric brain tumors, a nation wide epidemiological study needs to be conducted on the subject. Such a study can help us improve mortality and in allocation of resources to disease control and prevention programs.

## CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

## REFERENCES


1. Rosemberg S, Fujiwara D. Epidemiology of pediatric tumors of the nervous system according to the WHO 2000 classification: a report of 1,195 cases from a single institution. Child's Nervous System 2005; 21(11): 940-44.
2. Shah HC, Ubhale BP, Shah JK. Demographic and histopathologic profile of pediatric brain tumors: A hospital-based study. South Asian J Cancer 2015; 4(3): 146-49.
3. 3.Louis DN, Perry A, Reifenberger G, von Deimling A, Figarella-Branger D, Cavenee WK, et al. The 2016 World Health Organization classification of tumors of the central nervous system: a summary. Acta Neuropathol 2016; 131(6): 803-20.
4. Nasir S, Jamila B, Khaleeq S. A retrospective study of primary brain tumors in children under 14 years of age at PIMS, Islamabad. Asian Pac J Cancer Prev 2010; 11(5): 1225-27.
5. Wilne SH, Ferris RC, Nathwani A, Kennedy CR. The presenting features of brain tumours: a review of 200 cases. Archives of disease in childhood 2006; 91(6): 502-506.
6. Glod J, Rahme GJ, Kaur H, Raabe E, Hwang EI, Israel MA. Pediatric brain tumors: current knowledge and therapeutic opportunities. J Pediatric Hematol/Oncol 2016; 38(4): 249-52.
7. Ahmed N, Bhurgri Y, Sadiq S, Shakoor KA. Pediatric brain tumours at a tertiary care hospital in Karachi. Asian Pacific J Cancer Prevent 2007; 8(3): 399-402.
8. Makino K, Nakamura H, Yano S, Kuratsu JI. Population-based epidemiological study of primary intracranial tumors in childhood. Child's Nervous System 2010; 26(8): 1029-34.
9. Zhang R, Shen WQ, Zhou LF. Primary pediatric central nervous system tumors statistic: study of 763 cases in a single institution. Zhonghua Yi Xue Za Zhi 2007; 87(7): 442-47.
10. Jain A, Sharma MC, Suri V, Kale SS, Mahapatra AK, Tatke M, et al. Spectrum of pediatric brain tumors in India: A multi-institutional study. Neurol Ind 2011; 59(2): 208-215.
11. Zhou D, Zhang Y, Liu H, Luo S, Luo L, Dai K. Epidemiology of nervous system tumors in children: a survey of 1,485 cases in Beijing Tiantan Hospital from 2001 to 2005. Pediatric Neuros 2008; 44(2): 97-103.
12. Neervoort FW, Van Ouwerkerk WJ, Folkersma H, Kaspers GJ, Vandertop WP. Surgical morbidity and mortality of pediatric brain tumors: a single center audit. Child's Nervous System 2010; 26(11): 1583-92.
13. Rickert CH, Paulus W. Epidemiology of central nervous system tumors in childhood and adolescence based on the new WHO classification. Child's Nervous System 2001; 17(9): 503-11.
14. Chan GC. Recent advances in childhood brain tumours. HK J Paediatr (new series) 2006; 11(1): 3-12.
15. Mc Neill KA. Epidemiology of brain tumors. Neurol Clinics 2016; 34(4): 981-98.
16. Liu AP, Liu Q, Shing MM, Ku DT, Fu E, Luk CW, et al. Incidence and outcomes of CNS tumors in chinese children: comparative analysis with the surveillance, epidemiology, and end results program. JCO Global Oncol 2020; 6(1): 704-21.

17. Margam SR, Gadgil NM, Kshirsagar GR, Gaikwad VP, Kumavat PV, Chaudhari CS. The histopathological and epidemiological study of pediatric brain tumors in a tertiary care hospital, Mumbai. Annals Pathol Laborat Med 2016; 3(5): 375-81.

18. Mehrvar N, Mehrvar A, Akbari ME, Qaddoumi I. Comprehensive analysis of Iranian reports of pediatric central nervous system tumors. Child's Nervous System 2017; 33(9): 1481-90.