



Profile and management of pediatric brain tumors: A single-center experience

[Perfil y tratamiento de los tumores cerebrales pediátricos: una experiencia de un solo centro]

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Abstract

Context: Pediatric brain tumors are the most common solid tumors and the leading cause of death among children worldwide. Although there are some published studies from many countries regarding the pathological model of pediatric brain tumors, comprehensive clinical pathology studies conducted at Vietnam are still lacking.

Aims: To explore the clinical and histopathological features of pediatric brain tumors at a central hospital in Vietnam.

Methods: This study used a retrospective epidemiological approach. Children aged <17 years were selected according to their profiles registered in our department during 2016–2020 when they were diagnosed with primary brain tumors. Data of patients' age, sex, clinical features, and histology were collected. The 2016 World Health Organization classification of tumors was adopted.

Results: A total of 34 patients with brain tumors were identified, with a males/females ratio of 2.8/1. Patients' age ranged from 3 months to 16 years, with a median age of 6 years. The most common presentation of brain tumor in our series was headache (47.1%). According to the location of involvement, 51.5% of the tumors were in supratentorial region. Moreover, astrocytes (55.9%) were the most common type of pediatric brain tumors. Surgery was the main treatment, and chemotherapy was administered to 14.7% of patients.

Conclusions: This study addresses the issue of sensitivity but not that of specificity of clinical features to the presence of an underlying brain tumor. Histopathology analysis is necessary to develop further treatment after neurosurgery.

Keywords: brain tumor; childhood; clinical features; pathology.

Resumen

Contexto: Los tumores cerebrales pediátricos son los tumores sólidos más comunes y la principal causa de muerte entre los niños en todo el mundo. Aunque existen algunos estudios publicados de muchos países sobre el modelo patológico de los tumores cerebrales pediátricos, todavía faltan estudios completos de patología clínica realizados en Vietnam.

Objetivos: Explorar las características clínicas e histopatológicas de los tumores cerebrales pediátricos en un hospital central de Vietnam.

Métodos: Este estudio utilizó un enfoque epidemiológico retrospectivo. Los niños menores de 17 años fueron seleccionados según sus perfiles registrados en nuestro servicio durante el período 2016-2020 cuando fueron diagnosticados de tumores cerebrales primarios. Se recopilaron datos de la edad, el sexo, las características clínicas y la histología de los pacientes. Se adoptó la clasificación de tumores de la Organización Mundial de la Salud de 2016.

Resultados: Se identificaron un total de 34 pacientes con tumores cerebrales, con una relación hombres/mujeres de 2,8/1. La edad de los pacientes varió de 3 meses a 16 años, con una mediana de edad de 6 años. La presentación más frecuente de tumor cerebral en nuestra serie fue la cefalea (47,1%). Según la localización de la afectación, el 51,5% de los tumores se encontraban en región supratentorial. Además, los astrocitos (55,9%) fueron el tipo más común de tumores cerebrales pediátricos. La cirugía fue el tratamiento principal y se administró quimioterapia al 14,7% de los pacientes.

Conclusiones: Este estudio aborda el tema de la sensibilidad pero no el de la especificidad de las características clínicas a la presencia de un tumor cerebral subyacente. El análisis histopatológico es necesario para desarrollar un tratamiento posterior después de la neurocirugía.

Palabras Clave: características clínicas; infancia; patología; tumor cerebral.

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INTRODUCTION

Pediatric brain tumors are the most common solid tumors and the leading cause of death among pediatric population (Johnson et al., 2014). The incidence of pediatric brain tumors varies with each country. These tumors range from 1.15 to 5.14 cases per 100 000 children, with the highest rates reported in the United States. The incidence of pediatric brain tumors ranges from approximately 0.3 to 2.9 cases per 100 000 children living in different regions of the world (Subramanian and Ahmad, 2020). The prognosis and survival rates depend on many factors including histological classification and tumor location. In a previous report in Vietnam, the central nervous system tumors accounted for an average of 1.4–2.2 cases per 100,000 children (Nguyen et al., 1998).

Brain tumors in children are unique in terms of distribution, clinical manifestation, pathology type, treatment, and prognosis. Even in childhood onset, there are differences when the onset is in early childhood and in the late stage of different factors. Accurate diagnosis of a brain tumor requires best non-invasive and invasive techniques such as radiography, squash cytology in surgery, postoperative biopsy, and tumor histopathology.

Thus far, only few studies have examined the clinicopathological pattern of pediatric brain tumors and compared the results with the data from other countries worldwide. Moreover, there is a lack of comprehensive clinical pathology studies on pediatric brain tumors from Vietnam. This study aims to determine the clinicopathological characteristics and management of brain tumors among children at Hue Central Hospital in Vietnam.

MATERIAL AND METHODS

A retrospective epidemiological study was performed in children with brain tumor. The data were obtained from the histopathological reports in the Pathology Department of Hue Central Hospital during a 5-year study period (2016–2020). Intentional sampling of patients was performed,

and all study subjects with brain tumors who consulted the department were included. Patients with non-cancerous and inflammatory lesions of the brain were excluded. Patients with incomplete data were also excluded from the study. All slides of eligible cases were retrieved and reviewed. Immunohistochemistry was performed when required.

Strict confidentiality of patient information was maintained during data processing. This study was approved by the Hospital Ethics Committee (HCH No. 127/2020).

Histological classification of pediatric brain tumors was based on the 2016 World Health Organization classification of tumors of the Central Nervous System (CNS) (Louis et al., 2007). Owing to small sample size in the study, clinical classification was used for statistical analysis. Subsequently, grade I and II tumors and grade III and IV tumors were classified as low grade and high grade, respectively. Data on age and sex distribution, clinical manifestations, tumor location, and histopathology by degree were recorded and analyzed using SPSS software.

RESULTS

In total, 34 primary brain tumor cases were registered in the Pathology Department during 2016–2020. Among the 34 cases, there was a male preponderance (73.5%), compared to the tumors in females, with a male/female ratio of 2.8/1. In the present series, median patient age was 6 years, with age ranging from 3 months to 16 years. Age distribution for tumors of the CNS is shown in Table 1.

Table 1. Age distribution.

Age group	n (%)
0–5	16 (47.1)
6–10	9 (26.5)
11–16	9 (26.5)
Total	34 (100%)

The highest number of cases was noted during the age of 0–5 years (16 cases, 47.1%). The most common presentation of brain tumor in our series was headache (16 cases, 47.1%). Other symptoms included vomiting (18 cases, 52.9%), neurologic deficits (16 cases, 47.1%), seizure (9 cases, 26.5%), and visual defects (7 cases, 20.6%) (Table 2). According to the location of involvement, 51.5% of the tumors were supratentorial in location.

Table 2. Clinical symptoms at presentation.

Clinical symptoms	n (%)
Headache (children aged >2 years)	17/27 (62.9)
Vomiting	18/34 (52.9)
Neurologic deficits	16/34 (47.1)
Seizures	9/34 (26.5)
Visual defects	7/34 (20.6)
Fever	3/34 (8.8%)

The present study shows that astrocytoma (55.9%) is the most common pediatric brain tumor. Other common tumors include medulloblastoma (26.5%), ependymoma (5.9%), oligodendroglioma (5.9%), and craniopharyngioma (5.9%). The percentages of the different histological types are shown in Table 3. Among 34 patients, 14 (41.2%) had high-grade tumors. Further analysis showed that high-grade tumors displayed a peak frequency in the 0–5 years age group and a highly significant inverse relationship with age ($r = -0.812$; $p = 0.004$) (data not shown).

Table 3. Percentage of various histologic types of brain tumors.

Histological findings	n (%)
Astrocytoma	19 (55.9)
Medulloblastoma	9 (26.5)
Ependymoma	2 (5.9)
Oligodendroglioma	2 (5.9)
Craniopharyngioma	2 (5.9)

In 47.1% of cases, ventricular-peritoneal shunt surgery was performed as the primary treatment to reduce increased intracranial pressure. Surgery

was the main treatment, while chemotherapy was administered to 14.7% of the patients as per Children's Oncology Group protocols.

DISCUSSION

The present study showed that nearly a half of the cases of brain tumor occurred in the age group of 0–5 years. This finding was similar to that reported by Johnson (Johnson et al., 2014). The male-to-female ratio in the study showed a male preponderance, and the same finding was reported in pediatric brain tumor cases in Kuwait (Katchy et al., 2013). This is most likely a reflection of gender distribution in the population at risk. The male-to-female ratio in pediatric brain tumors as reported in English literature varies from 1.08 to 2.52, with the highest ratio observed in Asians (Kadri et al., 2005; Makino et al., 2010).

The most common symptom in the patients of the study was headache (within children aged >2 years old). Headache was also known to be the most frequent complaint in another large series of children with brain tumors (Wilne et al., 2006). Other investigators drew attention to the fact that parents are experts on their own children's behavior, but parental concerns about behavior could lead to a large number of children being considered for investigation (Dixon-Woods et al., 2001). Any initial symptoms other than the subsequent seizure are accompanied by other symptoms or signs when diagnosed. The variety of clinical features is an important diagnostic tool.

Careful history-taking may be required to distinguish generalized seizures from focal epilepsy, particularly secondary general seizures. Focal epilepsy suggests the underlying structural causes, and the recent NICE (National Institute for Clinical Excellence) guidelines recommend that magnetic resonance imaging (MRI) is particularly important in children with any hint of focal onset on history, examination, or electroencephalogram (unless there is clear evidence of benign focal epilepsy). MRI examination for four weeks is also recommended for children who develop epilepsy before 2 years of age or those who continue to have seizures despite the first drug treatment. Adoption of

this policy in the present study will lead to the diagnosis of tumors in all children with focal seizures. The likelihood of detecting an underlying structural cause in a child with generalized seizures and without a history and normal examination is low, and imaging in idiopathic generalized epilepsy is not recommended in the NICE guidelines. There are more than one hundred different histological subtypes of CNS tumors with the incidence of each subtype was different by histologic subtype as well as by age (Johnson et al., 2014). Astrocytoma is the most common pediatric brain in the study. The dominance of astrocytoma in childhood is consistent with findings reported in studies conducted in most countries including Kuwait (Katchy et al., 2013), Iran, and other Middle-Eastern countries (Rickert and Paulus, 2001; Mehrazin and Yavari, 2007). In contrast, medulloblastoma is the most common pediatric brain tumor in Syria (Kadri et al., 2005). In addition, a significantly higher proportion of craniopharyngioma is reported in Syria than in Kuwait and Iran. Both studies suggest intra-regional differences in the incidence of pediatric brain tumors.

In the Western population, it is found that astrocytomas and medulloblastomas are the two most common types of pediatric brain tumors. These histological types were also the most common tumors in our study. Various studies conducted in Asian centers also confirm these data. Another interesting observation is that ependymoma is the third most common type of pediatric brain tumor in Western countries, especially from Germany (Kaatsch et al., 2001), Canada (Kadri et al., 2005), Sweden (Hjalmars et al., 1999), and Morocco (Karkouri et al., 2010). The same finding is noted in the present study. In contrast, craniopharyngioma was the third most common tumor in many Asian studies conducted in Korea (Suh et al., 2002), Beijing (Zhou et al., 2008), and Japan (Makino et al., 2010). Another noted finding is that the incidence of oligodendroglioma in most of these studies was lower than that in our study. This is consistent with the finding reported in the Beijing study, with a higher incidence of oligodendrogliomas (6.2%) (Zhou et al., 2008).

Multimodal approaches including total or partial surgery, radiation and chemotherapy are fundamental in the management of brain tumors in children. The degree of completion of surgical resection often determines the treatment outcome. In a study by Madhavan et al. (2016), surgery was postponed in 16% of patients due to the diffuse infiltrative nature of the brain stem disease or the patient's poor performance. In children aged <3 years, radiation therapy was postponed, and chemotherapy was initiated. Older children with poor conditions also do not receive radiation.

The main limitation of this study is that it is a single-center study and therefore may not be generalized to the national population. The evolution of the patients after initial treatment were unknown due to lacking outcome data. An increasing number of such studies from various cancer centers across Vietnam help to compile the epidemiological profile of brain tumors in Vietnamese children and thus support the development of national treatment regimens.

CONCLUSIONS

This study addresses the issue of sensitivity but not that of specificity of signs and symptoms to the presence of an underlying brain tumor. Various morphological types of brain tumors occur in different age groups. Histopathological diagnosis is necessary for the formulation of further management after neurosurgery. The present study provides a current outlook to the epidemiology and clinicopathological aspects of different brain tumors in children.

CONFLICT OF INTEREST

The authors declare no conflicts of interests.

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AUTHOR CONTRIBUTION:

Contribution	Pham NH	Nguyen HS	Tran KH	Pham NC
Concepts or ideas	x	x	x	
Design	x	x	x	
Definition of intellectual content	x	x	x	
Literature search	x	x	x	
Experimental studies	x	x	x	
Data acquisition		x		x
Data analysis		x		x
Statistical analysis		x		x
Manuscript preparation		x		
Manuscript editing		x		
Manuscript review	x	x	x	x

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