RESEARCH ARTICLE

A 10 YEAR SURVEY ON CHILDHOOD CNS TUMORS

F. Jadali MD [1],
A. Almasi MD [2],
A. Gharib MD [3],
A. Zali MD [4],
H.R. Mohammadi MD [5],
A. Farzan MD [5]

1. Pediatric pathologist, Associate professor, Shahid Beheshti Medical University
2. Pathologist, Iranian blood transfusion center.
3. Pathologist, Assistant professor, Shahid Beheshti Medical University
4. Neurosurgeon, Associate Professor, Shahid Beheshti Medical University
5. Neurosurgeon, Assistant Professor, Shahid Beheshti Medical University

Corresponding Author:
F. Jadali MD
Mofid Children Hospital
Tel: +98 21 22227021-28
E-mail: fjadali@hotmail.com

Abstract

Objective

Tumors of the central nervous system constitute the largest group of solid neoplasms in children and are second only to leukemia in their overall frequency during childhood. The main purpose of the present study is to determine the incidence, age, sex, location and histological diagnosis of CNS tumors in children, less than 15 years of age, in the Mofid Children's Hospital, in the past 10 years.

Materials and Methods

In this descriptive retrospective study we reviewed the medical records of 143 children with diagnosis of CNS tumors admitted during the past 10 years in neurology and surgery departments of Mofid Children's Hospital between the years 1996 and 2006.

Results

During the 10 year study period, CNS tumor was diagnosed in 143 patients; of these tumors, 119 were intracranial and 58 were intraspinal; 51.3% of brain tumors were located in the supratentorial and 48.7% in the infratentorial regions. The most common intracranial neoplasms were astrocytic tumors (36.8%), embryonal tumors (31.1%) and ependymal tumors (13.4%). Of the intraspinal neoplasms the most frequently noted were embryonal tumors (37.5%), mesenchymal meningothelial tumors (20.8%), followed by astrocytic tumors (16.7%). The median age at diagnosis was 8.9 ± 4.1 years with a male to female ratio of 1.4:1 ($P<0.5$). The most common intracranial astrocytic and embryonal neoplasms were pilocytic astrocytoma and medulloblastoma / PNET respectively.

Conclusion

Brain tumors in children constitute a diverse group in terms of incidence, distribution and histopathological diagnosis.

Keywords: CNS tumors, Histopathology, Children.

Introduction:

After leukemia/lymphoma, CNS tumors are the second most common childhood tumors. Unlike brain tumors in adults, significant proportions of those occurring in children grow relatively slowly and are associated with an excellent prognosis. Categorization of brain tumors previously depended on characteristic histologic features, but important advances in immunohistochemistry and molecular biology have significantly altered this reliance on conventional histology. At the WHO international meetings in Zurich in March 1990, and Lyon, France, 1999, a consensus

was reached on a classification for brain tumors which was published in 2000 (1).

Eighty eight percent of the tumors fall into one of four categories:astrocytoma,ependymoma,craniopharyngioma, and primitive neuroectodermal tumor (embryonal tumors, including medulloblastoma). The remaining 12% consist of less frequently occurring tumors such as germ cell, choroid plexus and sub ependymal giant cell tumors.

Materials and Methods

In this descriptive retrospective study, to indicate the variety of histopathological patterns of pediatric CNS tumors, we reviewed the medical records of 143 patients diagnosed with CNS tumors, hospitalized in the neurology and surgery departments of Mofid Children's Hospital between the years 1996 and 2006. Files were reviewed to extract information about age, sex, location and histopathological diagnosis of tumors. All patients enrolled in the study had pathologically proven CNS tumors, locations of which were determined by cranial computed tomography and/or magnetic resonance imaging; those tumors located above the tentorium cerebelli were defined as supratentorial and those below as infratentorial. The histopathological evaluation of these lesions was performed on H&E stained sections of paraffin embedded tissues. Some cases had immunohistochemistry reports. Slides were reviewed by two pathologists and the latest WHO classification of brain tumor pathology was used (1, 2). Detailed analysis of each histopathological type of tumor relative to age at diagnosis, sex, and anatomical location were reported for both intracranial and intraspinal neoplasms.

Results

Of 143 central nervous system neoplasms occurring in children over a 10-year period (1996-2006), 119 (83.2%) were intracranial and 24 (16.8%) were intraspinal. Of 119 intracranial tumors, 61 (51.3%) were supratentorial and 58 (48.7%) were infratentorial, as shown in table 1 and figure 1; location of intracranial tumors is given in table 2 and figure 2. Table 3 gives data on the 24 cases of intraspinal neoplasms; file information about the location of intraspinal tumors was incomplete.

Of 143 patients aged 15 years and below, 84 (58.7%) were male and 59 (41.3%) were female (male to female ratio was 1.4:1). The mean age of patients at the time of diagnosis was 8.9 years (Table 4 and figure 3).

Table 1: Classification of intracranial supratentorial neoplasms (n=61)

Tumor type	Number (%)
Astrocytic tumors	20 (32.8%)
Embryonal tumors	10 (16.4%)
Ependymal tumors	8 (13.1%)
Tumors of sellar region	6 (9.8%)
Mixed gliomas	4 (6.6%)
Glial tumors of uncertain origin	3 (4.9%)
Choroid plexus tumors	3 (4.9%)
Tumors of meningothelial cells	2 (3.3%)
Mesenchymal, nonmeningothelial Tumors	2 (3.3%)
Neuronal and mixed neuronal glial tumor	2 (3.3%)
Metastatic tumors	1 (1.6%)

Table 2: Location of intracranial supratentorial neoplasms (n=61)

Tumor type	Number (%)
Hemispheric	40 (45.6%)
Intraventricular	12 (19.7%)
Suprasellar	6 (9.8%)
Optic nerve	2 (3.3%)
Pineal region	1 (1.6%)

Table 3: Classification of intraspinal neoplasms (n=24)

Tumor type	Number (%)
Embryonal tumors	9 (37.5%)
Mesenchymal, nonmeningothelial Tumors	(20.8%) 5
Astrocytic tumors	(16.7%) 4
Tumors of meningothelial cells	(12.5%) 3
Germ cell tumors	1 (4.2%)
Lymphomas and haematopoietic neoplasms	1 (4.2%)
Neuronal and mixed neuronal-glial tumors	1 (4.2%)

Table 4: The incidence of CNS tumors in different ages

Tumor type Age of occurrence	Number (%)
<1 year old	19 cases (13.3%)
1 year old	12 cases (8.4%)
2 year old	18 cases (12.6%)
3 year old	9 cases (6.3%)
4 year old	7 cases (4.9%)
5 year old	9 cases (6.3%)
6 year old	13 cases (9.1%)
7 year old	11 cases (7.7%)
8 year old	7 cases (4.9%)
9 year old	9 cases (6.3%)
10 year old	11 cases (7.7%)
11 year old	3 cases (2.1%)
12 year old	11 cases (7.7%)
13 year old	1 cases (0.7%)
14 year old	2 cases (1.4%)
15 year old	1 cases (0.7%)

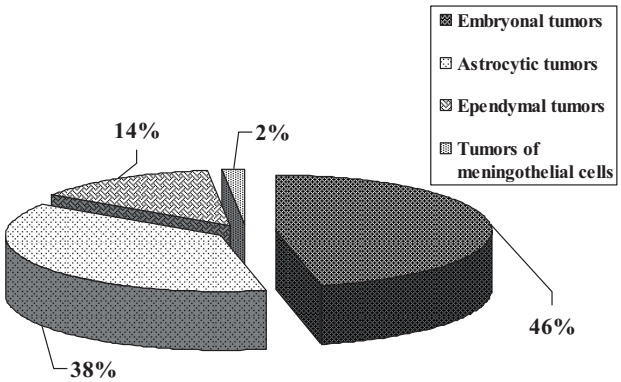

Fig 1. The location of intracranial supratentorial neoplasm (n=61)

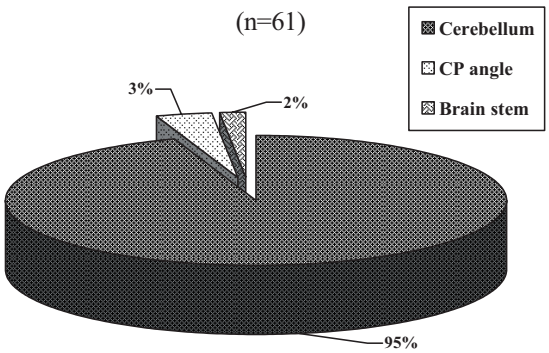

Fig 2. The location of intracranial infratentorial neoplasms (n=58)

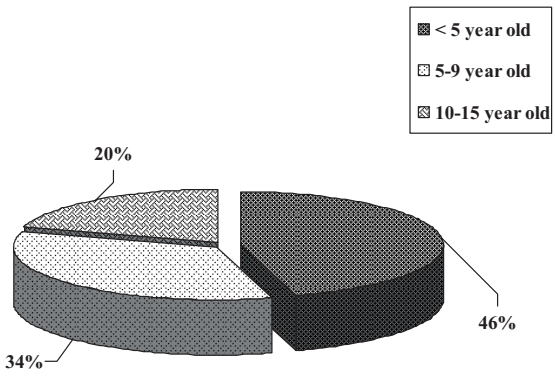

Fig 3. The incidence of CNS tumors in different age groups

Discussion

Primary malignant tumors of central nervous system, which account for about 16% of all childhood malignancies, are the second most common type of childhood cancer and the most frequent of solid tumors (3).

In our patient population, the male to female ratio was 1.4: 1. The mean age of patients at the time of diagnosis was 8.9 years (SD=4.1). A previous study conducted by Mehrazin M. et al showed results similar to ours (4), whereas Farwell JR et al showed a peak incidence among 10 year olds (17).

In our patient group the age distribution was not uniform, as the age group 0 to 4 years, included more children than age groups 5 to 9 and 10 to 15. Lannering B. et al reported the same results (10), although Mehdizadeh M. et al showed a higher incidence among the 10-15 year age group (6).

In our study, of 119 intracranial tumors, 51.3% were located in the_supratentorial and 48.7% in the infratentorial region, a conclusion in agreement with some previous studies (4, 6), but differing with others (5, 8, 11).

In the supratentorial region, 45.6% of tumors were in the hemispheres, 19.7% intraventricular and others were located in the suprasellar, optic nerve and pineal regions (Table 2).

In infratentorial region, 94.8% of tumors were located in the cerebellum and others in the LP angle and brainstem, a finding in agreement with a previous study (4).

The majority of supratentorial tumors were astrocytic (32.8%) and embryonal tumors (16.4%), followed by ependymal tumors (13.1%), and tumors of the sellar region (9.8%) (Table 1).

The majority of infratentorial tumors were embryonal (46.6%) and astrocytic tumors (37.9%), followed by ependymal tumors and tumors of meningothelial cells (1.7%) (Figure 1).

The most common intracranial tumors were astrocytic tumors, 36.8% (44 of 119), after which ranked embryonal tumors, 31.1% (37 of 119), followed by ependymal tumors, 13.4% (16 of 119); these results are similar to those of previous studies (4, 5, 7, 10).

In their study, the most common tumors found by Kadri H. et al were medulloblastoma, followed by astrocytoma and craniopharyngioma (8); the most common intracranial astrocytic and embryonal neoplasms were pilocytic astrocytoma and medulloblastoma/ PENT respectively.

In the present study, the most common intraspinal neoplasms were embryonal tumors (37.5%) and mesenchymal non meningothelial tumors (20.8%), followed by astrocytic tumors (16.7%) and tumors of meningothelial cells (12.5%) (Table 3).

Farwell Jacqueline R. et al, in their study, reported intraspinal astrocytoma and ependymal neoplasms to be the most frequent (7).

In our patient population, the incidence and distribution of CNS tumors differed somewhat to those reported by other investigators. Overall, it can be concluded that pediatric CNS tumors are diverse, presenting many histological types and occur in various anatomic sites.

Reference

1. J Thomas Stocker, Louis P Dehner. Pediatric pathology.2nd ed. Lippincott William's & Wilkins;2001. P. 385-397.
2. Rosenblum MK, Bilbas JM, ANG LC.Neuromuscular system. In: Rosai J, editor. Rosai and Ackerman's surgical pathology. Edinburgh London: Mosby; 2004. P.2504-7.
3. Sklar CA. Chilhood brain tumors. J Pediatr Endocrinol Metab 2002 May; 15 suppl (2): 669-73.
4. Merazin M, Yavari P.Morphological pattern and frequency of intracranial tumors in children. Children's Nervous System 2007 Febuary;23(2):157-62.
5. Mahzoni P, Afshar Moghadam N.Histopathological study of primary pediatric brain tumor from 1993 to 2003 in Isfahan. J of Research in Medical Science 2006;11(3):203.
6. Mehdizadeh M, Zamani G. Study of Brain Tumor in children, an Iranian experience. Neuropediatrics 2006; 37.
7. Farwell Jacqueline R, Dohrmann George J, Flannery John T. Central nervous system tumors in children. Cancer 2006 Jun;40(6):3123-32.
8. Kadri H, Mawla Alhakam A, Murad L. Incidence of childhood brain tumors in Syria (1993-2002). Pediatric Neurosurgery 2005;41(4):173-7.
9. Mittenburg D, Louw DF, Sutherland GR. Epidemiology of childhood brain tumors. Can J Neurol Sci 1996 May; 23(2):118-22.
10. Lannering B, Marky I, Nordborg C. Brain tumors in childhood and adolescence in West Sweden 1970-1984. Epidemiology and survival. Cancer 1990 Aug;66(3): 604-9.
11. Pollack Land F. Pediatric brain tumors. Seminars Surgical Oncology 1999;16 (2):73-90.