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An epidemiological study of paediatric central nervous system (CNS) tumours in Gujarat cancer research institute, Ahmedabad

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ABSTRACT

Paediatric brain tumours are the most common solid tumours in children and hence, leading cause of mortality and morbidity in children in our country. Though we have enough statistical data about its epidemiology in western population, there are only a few reports from developing countries like India.

Aims: To study the epidemiological patterns of brain tumours in children in our institute.

Materials and Methods: It is a medical record based observational study in which retrospective epidemiological approach is used. The records of 50 children <18 years registered in our department suffering from primary brain malignancy over a period of one year are selected. Data regarding age, sex, site of the tumour, clinical features, histology and immunohistochemistry are collected. The World Health Organization classification 2016 of neoplasms is adopted.

Results: Male patients falling under the age group of 6-10 years is the most common age group in which these tumours are diagnosed. The most common primary paediatric brain tumours were astrocytic tumours (28%), followed by medulloblastoma (26%) and ependymoma (16%). The most common astrocytic tumour was pilocytic astrocytoma.

Conclusion: Our study is an attempt to analyse the epidemiological pattern of paediatric CNS tumours in premiere tertiary care cancer institute of western India which showed the histological profile of paediatric brain tumours in India is like that reported in the Western literature.

1. Introduction

In children under 15 years of age, brain tumours are second most common type of tumours after leukemia and represent around approximately twenty percent of childhood malignancies.[1] According to the Indian Council of Medical Research, National Cancer Registry data, the incidence of paediatric brain tumours varies from 0% to 2.11%.[2]

Childhood central nervous system (CNS) tumours differ from adult brain tumours with respect to their primary sites of origin, clinical features, tendency to spread early, histological characteristics and their biological behaviour. Unlike adults, almost fifty percent of all the childhood brain tumours are in the infratentorial region. The predominant CNS tumour types in adults are metastases, glial neoplasms and meningiomas, whereas in children, major tumour include gliomas and primitive embryonal neoplasms.

Extensive tumour surgical resection and chemotherapy above radiation are advised for paediatric brain tumours.[3] Fortunately, as compared to adults, brain tumours in the paediatric age group carry a better prognosis.[4] Prognosis and 5-year survival depend not only on the type of tumour and its grade but only on its location, duration of symptoms, speed of growth, and infiltration into normal brain parenchyma.[5]

Population-based studies are required to determine the cancer burden due to paediatric CNS malignancies and for the histological typing of brain tumours in India. There are very few studies published from India describing the prevalence of paediatric brain and spinal cord tumours. This data will greatly contribute to the indian database of

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paediatric CNS tumours.

2. Materials and Methods

This study is a retrospective medical record-based observational study carried out over a period of one year in the department of pathology at a tertiary referral centre of western India.

2.1. Inclusion criteria

Only those patients were under 18 years of age and diagnosed as well as treated in our hospital in the study duration were included in the study. Exclusion criteria

1. Patients who had received chemotherapy or radiotherapy before being admitted to our hospital.
2. Patients who had any other coexistent primary malignancies elsewhere in the body.
3. Patients who had any kind of developmental malformation in CNS.
4. Patients who were a known case of malignant metastasis from other parts of the body.

The hospital records of all the patients fulfilling the inclusion criteria were analyzed, and descriptive epidemiological records were created for the patients by age, sex, and histological variables according to the WHO grading of paediatric CNS tumours 2016.

3. Results

A total of 50 cases of primary paediatric CNS tumours were analysed in our department in a period of two years.

3.1. Sex distribution

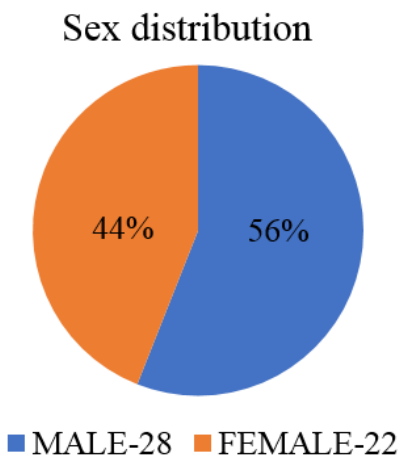

Fig. 1: Proportion of male vs female patients (Male : Female Ratio- 1.2:1)

Number of male patients were slightly more than female patients and male to female patients' ratio is 1.2:1.

3.2. Age distribution

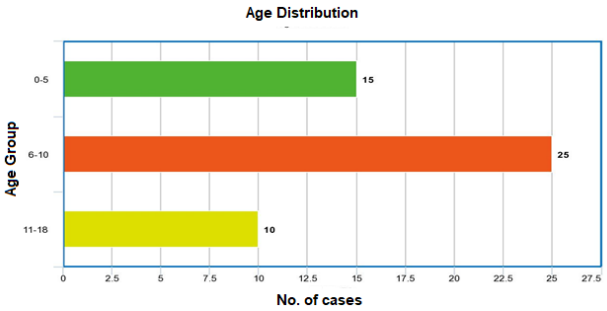

Fig. 2: Bar chart depicting frequency of disease indifferent age group

Most common age group noted was 6-10.

3.3. Location

Table 1: Primary site of disease

Location	Number	Percentage
Posterior fossa	18	36%
Ventricles	15	30%
Cerebrum	9	18%
Suprasellar	7	14%
Spinal cord	1	2%
Total	50	100%

Posterior fossa was the most common site of these tumours followed by ventricles.

Most common clinical symptoms at time of presentation in descending order of their frequency were headache, vomiting, neurological defects, seizures, visual deficits, and fever.

4. Discussion

Though still in our country, infections are a major cause of mortality in children, with the advent of antibiotics they have largely been controlled, and malignancies have emerged as a substantial aetiology of childhood mortalities.

The male: female ratio in our study is 1.2 :1 which is almost comparable to the study by Yeole *et al.*[6] and Nasir *et al.*[7] and is little more than the study done by seven premiere institutes of our country which was 1:1.2.[8] Male preponderance in India is likely due to the cultural factors wherein boys get more attention and are brought to the hospital more often for management. The mean age of paediatric brain tumours in our study is 8 years, higher than that observed in the study by Nasir *et al.* (6.7

Table 2: Histological subtype and grading of paediatric CNS tumours (Accordingto WHO classification of paediatric CNS Tumours 2016)

Type of tumour (no of cases)	Subtype (no of cases)	Grade (no of cases)	Percentage
Embryonal tumours (18)	Medulloblastoma (13)	Grade IV(13)	26%
	Embryonal tumour (2)	Grade IV(2)	4%
	PNET-(3)	Grade IV(3)	6%
Diffuse astrocytic and oligodendroglial tumours (17)	Astrocytoma (14)	Grade I (8) Grade II (4) Grade III (2)	28%
	Oligodendroglioma (1)	Grade II (1)	2%
	Glioblastoma (2)	Grade IV (2)	4%
Ependymal tumours (8)	Ependymoma (8)	Grade I (1) Grade II (5) Grade III (2)	16%
Meningioma (3)	Meningioma (3)	Grade I (1) Grade II (2)	6%
Tumour of the sellar origin (3)	Craniopharyngioma (3)	Grade I (3)	6%
Neuronal and mixed neuronal glial tumour (1)	Ganglioglioma(1)	Grade I (1)	2%

Table 3: Astrocytoma subclassification

Astrocytoma subtype	No of cases
Pilocytic astrocytoma	5
Diffuse astrocytoma	4
Pilomyxoid astrocytoma	3
Anaplastic astrocytoma	2
Total no of cases	14

Table 4: Embryonal tumour sub-classification

Embryonal tumour subtype	No of cases
Teratoid type	1
Multilayer rosette type	1
Total	2

years)[6] and comparable with the study done by Mehrazin and Yavari (8.7 years).[9] Even though some tumours tend to occur more frequently at certain specific ages, age itself is of no particular importance in diagnosing tumour type. All the tumours are known to occur at any age throughout childhood. Our series had more children in the second hemi decade of life (6–10 years) similar to previous study by Cushing.[10] The most common location of tumour in our study in descending order of frequency is posterior fossa (36%), ventricles (30%), cerebrum (18%), suprasellar (14%) and spinal cord (2%).

In our study, the most common histological type of brain tumours in the paediatric age group in descending order are astrocytoma (28%), medulloblastoma(26%), ependymoma(16%) followed by craniopharyngioma (6%) which is similar to large meta-analysis done by by Rickert and Paulius,[11] and little different from a study done by seven institutes of our country in which third most common tumour was craniopharyngioma followed by ependymoma.[8]

Symptoms and signs depend on the type of tumour, but also on its growth rate, location in the CNS, and age of the child.[12] Neurological symptoms produced by brain tumours are divided into general or local manifestations. General symptoms are due to increased intracranial pressure, which results directly from progressive enlargement of the tumour within the limited volume of the cranial vault and secondly causing blockage of the flow of cerebrospinal fluid; local symptoms are because of the pressure caused by tumour on contiguous areas of the brain. The most common presenting complaint for brain tumours in our study was headache, vomiting, seizures while ataxia was the most common clinical feature in spinal cord tumours.

Multimodality approach including surgery, chemotherapy, and radiotherapy is the cornerstone in the management of childhood brain tumours.[13]

Table 5: Relation between tumour type and location

Tumour type (no of cases)	Site of origin (no of cases)	Percentage
	Posterior fossa (8)	16%
Medulloblastoma (13)	Fourth ventricle (4)	8%
	Lateral ventricle (1)	2%
Embryonaltumour (2)	Posterior fossa (2)	4%
	Occipital lobe (1)	2%
PNET (3)	Parietal lobe (1)	2%
	Spine (1)	2%
	Posterior fossa (5)	10%
	Suprasellar (4)	8%
Astrocytoma (14)	3^{rd} ventricle (2)	4%
	Temporal lobe (2)	4%
	Intramedullary (1)	2%
Oligodendroglial tumour (1)	Frontal lobe (1)	2%
Glioblastoma (2)	Frontal lobe (2)	4%
	4^{th} ventricle (4)	8%
Ependymoma (8)	3^{rd} ventricle (3)	6%
	Lateral ventricles (1)	2%
	Frontal lobe (1)	2%
Meningioma (3)	Posterior fossa (1)	2%
	Parietal lobe (1)	2%
Craniopharyngioma (2)	Suprasellar (2)	4%
Ganglioglioma (1)	Suprasellar (1)	2%
Germ cell tumour (1)	Posterior fossa (1)	2%

5. Conclusion

This study is an attempt to map the epidemiology of paediatric brain tumours from western India, which revealed the histopathological diversity of childhood neurological neoplasms based on large hospital series of paediatric patients. The major limitation of the present study is that it is a single institution study and hence may not reflect the national statistics. More and more studies like this from various cancer centres across India help to project an epidemiological profile of Indian paediatric brain tumours and thereby aid in developing national treatment protocols. The study also reflects the need to strengthen the follow-up practices for providing the best possible care to our children. This may also result in adjustment of health programs.

6. Source of funding

None.

7. Conflict of interest

None

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