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Journal of Oncology Research
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ARTICLE

Spectrum of Pediatric Malignancies: An Observational Single Center Study from Western India

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ARTICLE INFO

Article history
Received: 29 August 2021
Accepted: 7 September 2021
Published Online: 13 September 2021

Keywords:
Pediatric cancer
Epidemiology
Leukemia
Tertiary health care

ABSTRACT

Cancer is a leading cause of death for children and adolescent worldwide. The cure rates in low middle-income countries are dismal (20%) in comparison to high income countries (80%). The first move is to assemble precise data on epidemiology of pediatric cancer across the country and its region wide variation. This study attempts to provide spectrum of pediatric malignancies from a tertiary care hospital in the state of Rajasthan, India.

A total of 140 cases were studied retrospectively over a period of two years (April 2018-March 2020). Patients, 0-18 years of age that are diagnosed as a case of malignancy were included in this study. The records of these patients were retrieved and analyzed.

Patients were stratified in 4 groups; 0-4 years, 5-9 years, 10-14 years and 15-18 years. Most of the patients fell in 15-18 year group (35.7%), followed by 5-9 year group (28.5%). Majority of cases, 67.8% were male. The male to female ratio is 2.1:1. Leukemia (40%) was the most common malignancy followed by lymphoma, retinoblastoma and malignant bone tumors. Acute lymphoblastic leukemia comprises majority (35/56) of leukemia. Retinoblastoma was predominant malignancy among <5-year children. In all other groups, leukemia was predominant.

This study gauges the trend of pediatric malignancies at one of the largest tertiary care hospitals in Rajasthan, which is important in the planning and evaluation of health strategies. As we lack a dedicated pediatric cancer registry, such epidemiological studies play a significant part for this small but distinguished group of patients.

1. Introduction

Cancer is one of the leading causes of death for children and adolescents around the world and approximately 300,000 children aged 0 to 19 years old are diagnosed with cancer each year [1].

In comparison to world, India has a lower incidence of pediatric cancer. As per the report of International Incidence of childhood cancer volume-3 (IICR-3), age-standardized rate of childhood cancer (0-19 year) incidence in India is 87.3 per million (pm) which is significantly lower than countries like US (180 pm), Canada (173.9 pm), Europe (170-190 pm) [1].

In India, data is collected through 33 population-based cancer registry and 29 hospital-based cancer registry which represents just 10% of population [2,3]. This high-

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DOI: https://doi.org/10.30564/jor.v3i2.3645

lights our knowledge gap regarding the true incidence of pediatric cancer in our country due to under reporting. Hence, leading to less diversion of resources for the management of pediatric cancer care and resulting in dismal outcomes in comparison to the western world [3,4]. Moreover there is regional variation in reporting due to disparity in infrastructure and socioeconomic factors. Our study is an attempt to strengthen the pediatric cancer epidemiological data and emphasize the demographic variations.

2. Material and Methods

It is a retrospective observational cohort study conducted over a period of two years (April 2018 to March 2020) in the department of medical oncology at a government tertiary health care cancer facility of Rajasthan after obtaining permission from concerned authority. The data of total 140 cases were collected from hospital records. All children aged 0-18 years, diagnosed as a case of malignancy by means of peripheral blood smears and bone marrow studies, cytological and histopathological examination during this period, were included in the study. Histological diagnosis was confirmed by our pathologist in all cases except for surgically inaccessible intracranial tumors. The records of these patients were retrieved and analyzed, focusing on the prevalence according to age, sex and types of tumors. For classification of pediatric malignancies in the present study, the International Classification of Childhood Cancers (ICCC), based on International Classification of Diseases for Oncology (ICD-O-3), was followed [5,6].

Statistical analysis

The data were entered in an EXCEL sheet and then analyzed. Descriptive statistics for continuous variables and frequency distribution, with their percentages were calculated as required.

3. Results

The data were recorded for 140 patients from age 0-18 years. Patients were stratified in four groups i.e 0-4 year, 5-9 year, 10-14 year and 15-18 year (Figure 1). Most of the patients (35.7 %) were placed in 15-18 year group (50/140), followed by 28.5% (40/140) patients in 5-9 year group. There were 18.5% and 17.1 % patients from age group 10-14 years (26/140) and 0-4 years (24/140). The mean and median age is 10.3 years and 11 years respectively in the present study. Sex wise distribution: Majority of cases, 67.8% were male (95/140) in comparison to 32.1% (45/140) were female (Figure 2). The male to female ratio is 2.1 in the current study.

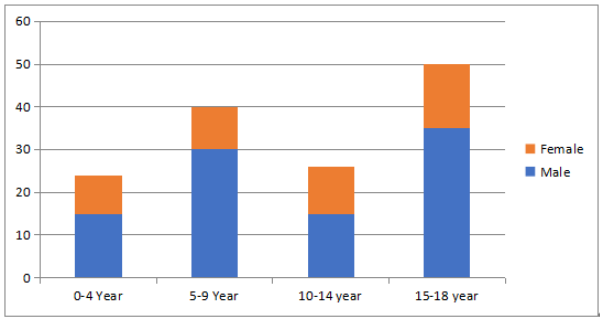

Figure 1. Stratification of patients as per age groups.

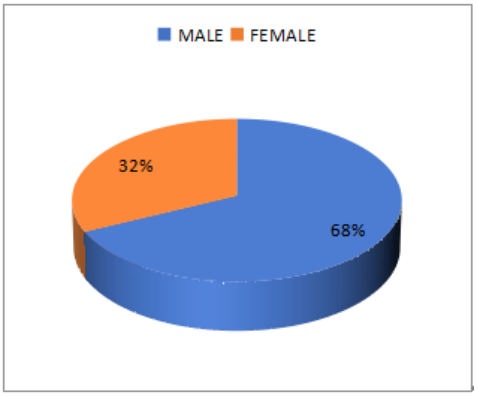

Figure 2. Sex wise distribution

Clinical Profile

Among all pediatric cancers, the most common was leukemia with 40% (56/140) of children affected (Figure 3/Table 1). The second most common was lymphoma 14.2% (20/140), followed by retinoblastoma 11.4% (16/140) and malignant bone tumors 10% (14/140). Germ cell tumor, neuroblastoma and renal tumors each constitute five percent (6/140) cases. Soft tissue sarcoma and CNS neoplasm were 5% (7/140) and 1.4% (2/140) respectively. Among others, there was a case of adrenocortical tumor in a 17-year-old boy.

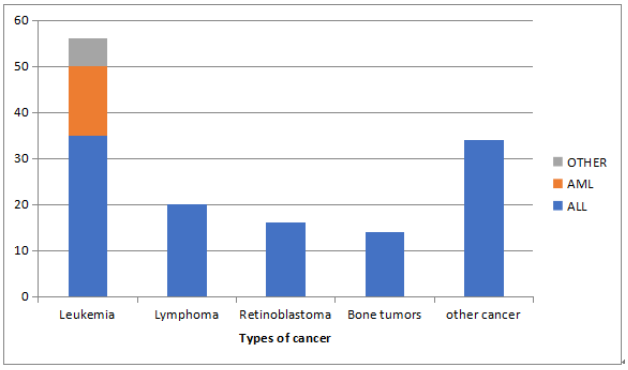

Figure 3. Frequency of various cancers among study population

DOI: https://doi.org/10.30564/jor.v3i2.3645

Table 1. Distribution of various cancers along the age groups

S.no.	Type of cancer		0-4 Years	5-9 years	10-14 years	15-18 years	Total	Total (percentage %)
1.	LEUKEMIA	ALL	0	12	7	16	35	56 (40%)
		AML	1	3	3	8	12	
		CML	0	0	1	3	04	
		MDS	0	0	1	0	01	
		Unspecified	0	0	1	0	01	
2.	LYMPHOMA	Hodgkin lymphoma	0	3	1	6	10	20 (14.2%)
		NHL	2	2	0	2	06	
		OTHER	1	1	2	0	04	
3	CNS NEOPLASMS		1	0	1	0	02	2(1.4%)
4	NEUROBLASTOMA		1	3	0	2	06	6 (4.2%)
5	RETINOBLASTOMA		9	5	1	1	16	16 (11.4%)
6	RENAL TUMORS (Wilms tumor)		3	3	0	0	06	6 (4.2%)
7	HEPATIC TUMORS		0	0	0	0	00	0
8	BONE TUMORS	Osteosarcoma	0	0	1	2	03	14 (10%)
		Ewing sarcoma	1	2	4	3	10	
		Other	0	0	0	1	01	
9	SOFT TISSUE SARCOMA	Rhabdomyosarcoma	1	1	0	1	03	7(5%)
		Other STS	1	2	1	0	04	
10	GERM CELL TUMOR		2	1	0	3	06	6(4.2%)
11	CARCINOMA AND MELANOMA		1	0	0	1	02	2 (1.4%)
12	OTHERS AND UNSPECIFIED		0	2	2	1	05	5 (3.5%)
Total			24	40	26	50	140	140
Percentage			17.1%	28.5%	18.5%	35.7%		100%

Among the subgroup of leukemia, acute lymphoblastic leukemia was the most common with 62.5% (35/56) cases. The most common age group affected was between 15 to 18 years with male predominance. Acute myeloid leukemia was 10.7% (15/140) of all the cases. There were 4 cases of chronic myeloid leukemia, 3 of them lie in age group 15 to 18. There was 10-year-old boy having myelodysplastic syndrome. Among the lymphoma subgroup, Hodgkin lymphoma was the commonest with 7.1% (10/140) cases. There was again male predominance with only single female case out of 10. The most common age group affected was 15 to 18 years. There were 4.2% of non-Hodgkin lymphoma and 4 cases of unspecified lymphoma. Ewings sarcoma (7.1%) was the commonest bone tumor followed by osteosarcoma (2.1%). Most of our patients (80%) were started on treatment protocol as per the diagnosis (Figure 4). Seven percent refused for further treatment and 13% were referred to palliative or best supportive care.

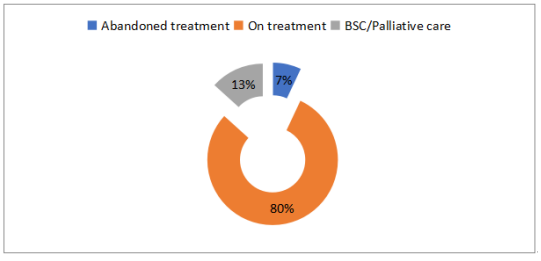

Figure 4. Follow up of the study cohort

4. Discussion

Childhood cancers are often neglected as they represent a small proportion of all cancers (0.7-4.4%) [3,7]. On the other hand when it occurs, it requires medical, psychological and societal concern. Childhood cancer incidence appears to be increasing in India [3,8]. As we contain the morbidity and mortality caused by infection and malnutrition, childhood cancer attain increasing priority in our country.

In the report of International Incidence of childhood cancer volume-3 (IICR-3), age-standardized rate of childhood cancer (0-19 year) incidence in India is 87.3 pm which is quite lower than countries like US (180 pm), Canada (173.9 pm) or Europe (170-190 pm) [1]. This discrepancy can be explained by delay in diagnosis, under-reporting, poor health care access, centralization of resources, less than 10% population coverage by cancer registries. 'Missing' cases can be attributed to myriad of reasons ranging from societal to availability of health care services [3].

In this study, we retrospectively analyzed the data regarding demographics and spectrum of malignancies in 140 pediatric patients (0-18 years) in a span of two years attending our tertiary health care facility.

As per IICR-3 [1], ASRs were higher in children aged 0-4 years (ASR 197.1 pm) and 15-19 years (ASR 185.3 pm) than in those aged 5-9 years and 10-14 years. Similar observation made in our study for the age group 15-18

DOI: https://doi.org/10.30564/jor.v3i2.3645

years of age (35.7%; 50/140 cases), but not for 0-4 years. The possible explanation can be that this age group of 0-4 years is obtaining treatment at the pediatric centre of our institute.

Incidence rates are slightly higher in boys than in girls (incidence sex ratio 1•14 in the 0-19 years age-group) and varied with age, region, and diagnostic group [1,3]. In IICR-3, the highest sex ratio incidence was reported from India (1.56) compared to 1.12-1.15 in high income countries (3). In our study, males were affected in 65.7% (95/140), while females were affected in 34.3% (45/140) cases. M: F ratio was 2.1:1. Similarly, Jussawalla et al [9] (1.7), Das et al [10] (2), Nandkumar et al [11] (1.8), Chauhan et al [12] (2.2) and Bryan et al [13] (4) reported high sex ratios in their studies. Although according to Kusumakumary et al [14], male predominance is a salient feature of many childhood tumors. This high ratio cannot be explained solely biologically or genetically but a large number of socio-cultural practices play in their part. Gender-based discrimination is seen in Southeast Asian countries which results into delayed healthcare seeking for all childhood illnesses including cancer [3,15].

Childhood cancers are more commonly derived from hematopoietic system, central nervous system, soft tissue, bone and kidney in contrast to adults in whom skin, lung, breast, prostate and colon are the mostly affected [16]. The three most common tumor in our study were leukemia (56/140; 40%), lymphoma (20/140;14.2%) and retinoblastoma (16/140;11.4%). Bhalodia et al. [17], Pattnaik et al. [18], Jan M et al. [19], Chauhan et al [12] and Chaudhuri et al. [20] also reported leukemia as the most common pediatric malignancy in their studies. IICR-3 [1] also reports leukemia as the most common cancer for 0-14 year but lymphoma among 15-19 year. Lymphoma comprises 16% (8/50) of patient among 15-18 year in this study. Our data found retinoblastoma as the most common malignancy among 0-4 year (9/24; 37.5%). Similar findings were reported by Jabeen et al [21] and Hazarika et al [22]. Leukemia was the most common malignancy among all other age groups (37-54%).

Malignant bone tumors were present in 10% (14/140) of our patients. This is in concordance with Pattnaik et al. [18], Chauhan et al. [12] and Devi S et al [23]. As in IICR-3 [1], renal tumors were common in children aged 0-4 years (3/24;12%) and 5-9 year (3/40;7.5%) and frequency decreased in older age groups (0%). ALL was the most commonly seen hematological malignancy (62%; 35/56 cases). This was in concordance with the studies of Bhalodia et al. [17], Satyanarayana et al. [8], Pattnaik et al. [18] and Chauhan et al [12]. Retinoblastoma was the most common non-hematological malignancy (16/64; 25%) followed by Ewing sarcoma (10/64; 15.6%). Chaudhuri et al. [20] also reported retinoblastoma as the most common non-hematological malignancy (19.2%). There was no case of hepatic tumor in our cohort and CNS neoplasm was observed in only 1.4% (2/140) cases. This may be due to delay in diagnosis, poor availability of imaging techniques and their prohibitive cost.

A SIOP report stressed that refusal; non-compliance and abandonment of medical treatment remain critical issue [24]. Although most of the patients (80%) in our study were started on disease-based protocol, further follow up data could not be retrieved. Twenty percent were not given disease specific treatment as few (7%; 10/140) refused and rest (13%; 19/140) had very advanced disease. Arora et al [25] reiterates the problem of abandonment in the developing countries for child hood cancer and suggests ways to improve treatment adherence.

Hence, we notice that various studies have shown inconsistent pattern of childhood cancer from our country. Retinoblastoma and leukemia were the most common malignancy in 0-4 year and 5-18-year group respectively. Leukemia, lymphoma, bone tumor and germ cell tumor occurred more commonly above five years of age, while retinoblastoma and Wilm's tumor were seen mostly in children less than five years.

Limitation

The present study is a single institution-based study. Small sample size and lack of follow-up served as a limitation.

5. Conclusions

This study gauges the trend of pediatric malignancies in Rajasthan, which is important in the planning and evaluation of health strategies. In India, where there is dearth of high-quality data as we lack a dedicated pediatric cancer registry, such epidemiological studies play a significant part for this small but distinguished group of patients.

Conflict of Interest

There was no conflict of interest.

All publication ethics were followed as per COPE guidelines.

Acknowledgement

I thank all my co-authors for helping, me to carry out this study and helping me to formulate the manuscript. I thank all the administrative and clinical staff in the department of medical oncology. At last, I extend my sincere gratitude towards all the patients and their families.

 DOI: https://doi.org/10.30564/jor.v3i2.3645

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