

Demographic Profile of Pediatric Malignancies in Himachal Pradesh

Abstract

Context: Pediatric malignancy is on the rise worldwide, and it is imperative to know the profile of pediatric malignancy in different geographical areas so as to formulate effective strategy to its control. As there are no data from this part, especially the Himalayan region of North India, the present study was planned. **Aims:** The aims of this study were to study the pattern and demographic profile of pediatric malignancies at a tertiary care teaching hospital in Himachal Pradesh. **Settings and Design:** This was a hospital-based, prospective, nonrandomized, observational study. **Subjects and Methods:** Pattern and demographic profile of clinically suspected malignancies in children and adolescents (0–18 years) over a period of 1 year from June 2012 to May 2013 in the Department of Pediatrics and Radiotherapy. **Statistical Analysis Used:** Data were analyzed statistically using Epi Info software for all ratios and proportions. **Results:** A total of 31 children were diagnosed to have malignancy, which accounted for 0.86% of total admissions with a male-to-female ratio of 1.58:1. The three most common childhood malignancies were leukemia (29.03%), central nervous system (CNS) tumors (25.80%), and lymphoma (19.35%), and these were followed by Wilm's tumor and hepatoblastoma, each accounting for 06.45% of total childhood malignancies. Hematological malignancies accounted for 48.38% and nonhematological malignancies for 51.62% of all the malignancies. Acute lymphoblastic leukemia was the most common hematological malignancy noted in 22.58%, followed equally by Hodgkin's disease and non-Hodgkin's lymphoma (20% of total hematological malignancies). Among nonhematological malignancies, CNS malignancies were the most common. In the age group of 0–5 years, all cases of neuroblastoma, yolk sac tumor, and ovarian tumor and 50% cases of hepatoblastoma and Wilm's tumor were seen. In the age group of 5–10 years, leukemia (44.44%) was the most common malignancy followed by lymphoma (33.33%). In 14–18 years, CNS malignancies (50%) were the most common malignancies followed by lymphoma (33.33%). **Conclusions:** Hematological malignancies are the most common malignancies in the pediatric age group, and acute leukemia was the single most common pediatric malignancy, and CNS malignancies were the most common nonhematological malignancies.

Keywords: Himalayas, malignancies, North India, pediatric

Introduction

In 2008, 7.6 million people died of cancer – 13% of all deaths worldwide. About 70% of all cancer deaths occur in low- and middle-income countries.^[1] Worldwide, the annual number of new cases of childhood cancer exceeds 200,000 and more than 80% of these are from the developing world.^[2] Cancer remains one of the major causes of death in children between the ages of 0–14 years.^[3] Pediatric cancers differ markedly from adult cancers in their nature, distribution, and prognosis. The incidence of childhood cancer and type vary greatly throughout the world. Although lower compared with the incidence of some adult cancers, it comes next to accidents as the leading cause of death among children

in the developed world, accounting for 10%–12.3% of all childhood deaths.^[3–6] In 2005, the International Union Against Cancer reported that, worldwide, more than 160,000 children are diagnosed with cancer per year, and about 90,000 die from cancer because of late presentation due to parental ignorance and poverty and poor health facilities.^[7] It has also been estimated that more than 85% of childhood cancer cases occurred in resource-poor countries, and it is possible that this will increase to 90% in the next two decades as a result of an expected rapid increase in the youth population.^[8] In developing countries like India, childhood mortality is still mainly due to malnutrition and infections, but pediatric tumors are also rising in number.^[4] As there is paucity of studies regarding the pattern of childhood malignancies from this part of north India, present study

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was conducted to ascertain the pattern of childhood malignancies in Himachal Pradesh.

Subjects and Methods

A prospective nonrandomized study was conducted in children (0–18 years) over a period of 1 year from June 2012 to May 2013 in the Department of Pediatrics and Radiotherapy at a tertiary teaching institute in North India. All the children aged ≤ 18 years with malignancies diagnosed by means of cytological or histopathological examination were enrolled in the study. Written informed consent was obtained from the parents/guardians of all patients. The study was approved by the Institutional Ethics Committee. The profile of childhood cancer was studied focusing on the proportion of malignancies according to (a) age at presentation (divided into four groups, i.e., 0–4 years, 5–9 years, 10–14 years, and 15–18 years), (b) sex, (c) rural and urban distribution, (d) site of origin of tumor, and (e) their histopathological diagnosis.

The cases were assessed clinically by taking relevant history and doing general physical examination. Specific investigations were undertaken to establish the diagnosis of malignancy. Hemoglobin, total leukocyte count, differential leukocyte count, and platelets count were analyzed by “COULTER’S MX-9” autoanalyzer. Bone marrow films were prepared from aspirated material and were stained using Romanowsky stain and examined under microscope. FNAC material obtained was smeared on glass slides fixed in 95% ethyl alcohol for Papanicolaou staining and air dried for Giemsa staining. Excision, incision, and true cut biopsy were done where ever indicated. Specialized stains were used for more accurate diagnoses. Radiological investigations such as X-ray, ultrasound, computed tomography (CT) scans, and magnetic resonance imaging (MRI) were done. Data were analyzed statistically using Epi Info software for all ratios and proportions.

Results

In this study period, out of 3605 children admitted, 31 were diagnosed to have malignancy, which accounted for 0.86% of admission, and a total of 1978 patients (children + adult) were diagnosed to have one or the other malignancy during this period; thus, childhood malignancies ($n = 31$) constituted 1.57% of total cancer burden. There were 19 males and 12 females. Males were affected (61.29%) more than females (38.71%) with a male-to-female ratio of 1.58:1.

In this study, the three most common childhood malignancies were leukemia (29.03%), central nervous system (CNS) tumors (25.80%), and lymphoma (19.35%) these were followed by Wilm’s tumor and hepatoblastoma, each accounting for 06.45% of total childhood malignancies as shown in Table 1.

Table 1: Types of malignancies diagnosed

Site	Malignancy	Number of cases
1) Hematological		
1a) Leukemia		
1aa)	ALL - L1	3
	ALL - L2	4
1ab)	AML - M2	1
	AML -M3	1
1b) Lymphoma		
1ba)	NHL	3
1bb)	HL-(MC)	2
	HL-(LP)	1
2) Nonhematological		
2a) CNS		
	Craniopharyngioma	3
	Medulloblastoma	2
	Meningioma	1
	Pinealoblastoma	1
	Thalamic glioma	1
2b)	Neuroendocrine	1
2c)	Thorax	1
	Teratoma anterior mediastinum	1
2d)	Hepatobiliary	2
2e)	Renal	2
2f)	Others	1
	Yolk sac tumor	1
	Ovarian tumor	1
All malignancies		31

ALL – Acute lymphoblastic leukemia; AML – Acute myeloid leukemia; NHL – Non-Hodgkin lymphoma; HL – Hodgkin lymphoma; CNS – Central nervous system; MC – Mixed cellularity; LP – Lymphocyte predominant

Hematological malignancies accounted for 48.38% and nonhematological malignancies for 51.62% of total pediatric malignancies.

In hematological malignancies, acute lymphoblastic leukemia was the most common accounting for 22.58% of total malignancies, 39.53% of total hematological malignancies, and 77.78% of acute leukemia. Among hematological malignancies, acute lymphoblastic leukemia is followed equally by Hodgkin’s disease and non-Hodgkin’s lymphoma (20% of total hematological malignancies each) followed by acute myeloid leukemia (13.33% of total hematological malignancies).

Among nonhematological malignancies, CNS malignancies accounted for 50% of malignancies followed by Wilm’s tumor and hepatoblastoma, each accounting for 06.45% of total childhood malignancies and 12.5% of total nonhematological malignancies. These were followed by sympathetic nervous system tumors (neuroblastoma), anterior mediastinal teratoma, yolk sac tumor, and ovarian tumor each accounting for 3.23% of total childhood malignancies and 6.25% of total nonhematological malignancies.

Craniopharyngioma was the most common CNS malignancy. It accounted for 9.68% of total malignancies,

Table 2: Age distribution of different childhood malignancies

Serial number	Malignancy	Age group				Total <18 years (100%)
		0-5 years (%)	5-10 years (%)	10-14 years (%)	14-18 years (%)	
1	Hematological	3 (20.00)	7 (46.67)	3 (20.00)	2 (13.33)	15
a	Leukemias	2 (22.22)	4 (44.45)	1 (11.11)	2 (22.22)	9
b	Lymphomas	1 (16.67)	3 (50.00)	2 (33.33)	0	6
2	CNS malignancy	2 (25.00)	1 (12.50)	2 (25.00)	3 (37.50)	8
3	Neuroblastoma	1 (100)	0	0	0	1
4	Teratoma anterior mediastinum	0	0	0	1 (100)	1
5	Hepatoblastoma	1 (50)	0	1 (50)	0	2
6	Wilm's tumor	1 (50)	1 (50)	0	0	2
7	Yolk sac tumor	1 (100)	0	0	0	1
8	Ovarian tumor	1 (100)	0	0	0	1
Total	All malignancies	10 (32.26)	09 (29.04)	6 (19.35)	6 (19.35)	31

CNS – Central nervous system

18.75% of total nonhematological malignancies, and 37.5% of CNS malignancies. Medulloblastoma was the second most common CNS malignancy. It accounted for 25% of total CNS malignancies followed by meningioma, pinealoblastoma, and thalamic glioma accounting for 12.5% of total CNS malignancies each as shown in Table 1.

Table 2 shows the age-wise distribution of pediatric malignancies.

In the age group of 0–5 years, nonhematological malignancies were more common (70.00%) than the hematological malignancies (30.00%). Leukemia (20.00%) was the most common malignancy in the 0–5-year group. All cases of leukemia were ALL. CNS malignancies were the most common nonhematological malignancies. All cases of neuroblastoma, yolk sac tumor, and ovarian tumor were in this age group. Almost 50% cases of hepatoblastoma and Wilm's tumor were in this age group. In the age group of 5–10 years, hematological malignancies were more common (77.78%) than the nonhematological malignancies (22.22%). Leukemia (44.44%) was the most common malignancy followed by lymphoma (33.33%). Nearly 75% cases of leukemia were ALL and 25% were AML. Only two cases of nonhematological malignancies were as follows: one of craniopharyngioma and one of Wilm's tumor. Almost 50% cases of Wilm's tumor were in this age group. In the age group of 10–14 years, hematological malignancies ($n = 3$) and nonhematological malignancies ($n = 3$) were equally common. Lymphoma (33.33%) was the most common malignancy in this age group. Among hematological malignancies, lymphoma (66.67%) was more common than leukemia (33.33%). All cases of leukemia were ALL. CNS (66.67%) malignancies were the most common nonhematological malignancies. In the age group of 14–18 years, hepatoblastoma constituted 16.67% of cases in this age group. Almost 50% cases of hepatoblastoma were in this age group. Nonhematological malignancies were more common (66.67%) than the hematological malignancies (33.33%). CNS malignancies (50%) were the

Table 3: Percentage of pediatric malignancies

Study	Place	Burden (percentage of total malignancies)
Rathi <i>et al.</i> ^[4]	New Delhi	3.38
Yeole, <i>et al.</i> ^[11]	Mumbai	3.3
Jignasa and Mandakini ^[10]	Surat (Gujarat)	2.0
Ferlay <i>et al.</i> ^[12]	USA	0.8
Arora <i>et al.</i> ^[2]	UK	0.5
Present study	HP	1.57

most common malignancies in this age group followed by lymphoma (33.33%). Craniopharyngioma, meningioma, and pinealoblastoma were equally common. Lymphoma was more common (66.67%) than leukemia (33.33%). ALL and AML were equally common. All cases of teratoma were in this age group.

Discussion

A limited number of retrospective and prospective studies have been conducted on demographic profile of childhood malignancies all over the world and more so from India and especially from the Northern part of the country. Most of these studies are on hematological malignancies, especially acute leukemia, the most common malignancy being observed all over the world among children. There are a very few places, especially in the western countries,^[9] where cancer registration system has been established and well maintained and that is why population-based studies can be conducted in those countries. Since our country lacks a well-maintained cancer registration system, we have to rely on hospital-based studies for epidemiological as well as other statistical data. In this study, the pediatric tumors constituted 1.57% of all the malignancies; our result is similar to Jignasa and Mandakini^[10] where they found 2.0% childhood cancer among all malignancies. Table 3 shows the comparison of various studies.

In this study, nonhematological malignancies were more common (51.62%) than the hematological malignancies (48.38%) and the three most common

Table 4: Comparison of proportion (%) of different pediatric malignancies

Tumor	USA ^[13]	UK ^[14]	Australia ^[15]	India ^[4]	Kerala ^[5]	Delhi ^[16]	Mumbai ^[11]	Present study
Leukemia	30.1	20.4	20.6	32.00	30.0	28.8	32.80	29.03
Lymphoma	12.3	8.7	10.3	14.08	10.0	11.5	12.65	19.35
CNS tumors	19.1	16.6	21.0	18.21	19.3	21.0	17.60	25.80
Neuroblastoma	8.1	7.5	7.4	4.21	5.1	4.1	-	03.23
Wilm's tumor	6.5	5.4	6.6	4.94	5.4	3.3	5.25	06.45
Bone tumors	4.8	4.8	5.3	7.66	5.4	3.3	3.85	0
Soft-tissue tumors	6.3	8.5	-	5.49	6.6	3.8	4.30	0
Other	10.1	16.0	17.1	18.35	13.8	11.8	19.00	16.13

CNS – Central nervous system

childhood malignancies were leukemia (29.03%), CNS tumors (25.80%), and lymphoma (19.35%). It is comparable with the data from the developed world, for example, in the USA,^[10] the three most frequent childhood cancers diagnosed were leukemia (30.2%), CNS cancers (21.7%), and lymphomas (10.9%).

Leukemias were the most common form of childhood malignancies and together with lymphoma constituted 30%–50% of all malignancies in different regions as seen in Table 4. In the present study, lymphoma and leukemia together constituted 48.38% of childhood malignancies. Among leukemias, the most common in different studies were acute leukemias, 75%–80% being ALL and 20%–25% AML.^[11] In the present study, ALL constitutes 77.78% of total leukemias and AML was 22.22% of leukemias.

In the present study, the incidence of pediatric CNS tumor is 25.80%, which is almost comparable with a study which is carried out at Delhi,^[15] but the incidence is much higher in our study than other studies done in and outside India. This may be because of round-the-clock availability of high-quality CT and MRI and early imaging of pediatric patients done on priority basis in our hospital. The incidence of Wilm's tumor (06.45%) is almost comparable with the data from the studies conducted in developed countries such as the USA,^[13] Australia,^[15] and developing African countries^[14] but slightly higher than other Indian studies.^[4,5,16] The proportion of neuroblastoma (03.23%) in our study was much lower than studies conducted in developed countries such as the USA,^[13] the UK,^[14] and Australia^[15] but comparable with different Indian studies.^[4,5,16] No case of bone tumors, soft-tissue tumors were diagnosed during this study period of 1 year. The incidence of childhood malignancies is higher in male than in female. Male and female ratio in the present study is 1.58:1, which is almost quite similar to Yeole *et al.*^[11] and Joshi and Kumar.^[17]

Male preponderance in our country could also be as a result of our cultural factors wherein boys get more attention and are brought to the hospital more often for management.^[10] The highest incidence was seen in 0–5 years (32.26%), followed by 5–10 years (29.04%), 10–14 years (19.35%), and 14–18 years (19.35%). The incidence of childhood

malignancies varied among different age groups. Although except this study, rest of the studies have not included adolescents above 14 years, so proportions in different age groups cannot be compared, but trends in our study are almost similar to Yeole *et al.*^[11] This study shows that the overall incidence of childhood malignancies was more in 0–5 years of age group and decreases gradually with age toward late adolescence and this is in concordance with other Indian studies.^[10,11] The number of cases belonging to rural area (90.32%) is more than those belonging to an urban area (9.68%) which is well comparable with the general population.

Conclusions

In this part of the country, the three most common malignancies are leukemia (29.03%), CNS tumors (25.80%), and lymphoma (19.35%). Nonhematological malignancies are more common (51.62%) than the hematological malignancies (48.38%). Acute lymphoblastic leukemia is the most common hematological malignancy. The most common nonhematological malignancies are CNS malignancies followed by Wilm's tumor and hepatoblastoma. Craniopharyngioma is most common CNS malignancy. Acute leukemia is most common in 5–10 years' age group and CNS malignancies are most common in 14–18 years' age group (37.50%). Male preponderance is seen in hematological malignancies (86.67%) (both leukemia and lymphoma). Female preponderance is seen in nonhematological malignancies. The number of cases belonging to rural area (90.32%) was more than those belonging to an urban area (9.68%).

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Conflicts of interest

There are no conflicts of interest.

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