

# Spectrum of Pediatric Malignancies at a Tertiary Care Centre in Western Uttar Pradesh

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## ABSTRACT

**Introduction:** Pediatric malignancies, although uncommon, are amongst the leading causes of death in children. These tumors show a distinctive incidence, histology and biological behaviour from those in adults.

**Aim:** This study was conducted to find out the spectrum of pediatric malignancies in LLRM Medical College and associated SVBP Hospital, Meerut, India.

**Materials and Methods:** A total of 51 cases were studied retrospectively over a period of five years. Patients, 0-14 years of age, diagnosed as a case of malignancy by means of peripheral blood smears and bone marrow studies, cytological and histopathological examination, were included in the study. The records of these tumors were retrieved and analyzed, focussing on the prevalence according to age, sex and types of tumors.

**Results:** Maximum number of cases (50.98%; 26/51) were seen in 10-14 years age group, followed by 29.41% (15/51) cases in 5-9 years age group and 19.61% (10/51) in 0-4

years. Males were affected in 68.63% (35/51) cases, while females were affected in 31.37% (16/51) cases. Male to female ratio was 2.2:1. Leukemias were found to be the most common pediatric cancers (29.4%; 15/51 cases), followed by lymphomas (17.65%; 09/51 cases), malignant bone tumors (11.8%; 06/51 cases), renal malignancies (9.8%; 05/51 cases), brain tumors, soft tissue sarcomas and germ cell tumors (7.8%; 04/51 cases each). In <5 years and 5-9 years age group, Acute Lymphoblastic Leukemia (ALL) was the predominant malignancy (30% and 26.67% respectively). In 10-14 years of age, both ALL and Osteosarcoma accounted for the majority cases (15.38% each).

**Conclusion:** This institution based study provides an insight into the pattern of distribution of childhood cancers in Western Uttar Pradesh region, which is important in the planning and evaluation of health strategies. In India, where there is scarcity of data because of lack of a dedicated pediatric cancer registry, such studies play a major role in effective disease management for this small but important group of patients.

**Keywords:** Biological behaviour, Childhood cancers, Leukemia

## INTRODUCTION

Pediatric malignancies are uncommon, comprising only 1% of all the cancers [1]. According to the latest data of American Cancer Society, childhood cancer incidence rates have slowly increased by 0.6% per year since 1975. An estimated 10,380 new cases are expected to occur among children 0 to 14 years of age in 2016. Cancer is the second leading cause of death in children aged 1-14 years in the United States, exceeded only by accidents [2].

In India, approximately 45000 children are diagnosed with cancer every year [3]. Indian Cancer Registries reported that pediatric malignancies accounted for 0.8% to 5.8% malignancies in boys and 0.5% to 3.4% in girls [4].

Pediatric tumors show a distinctive incidence, histology and biologic behaviour from those in adults [5]. In addition, fetal and neonatal malignancies tend to differentiate or regress spontaneously, leading to high survival and curability rates [6].

It has been firmly established that for children, classification of tumors should be based on morphology rather than, as in adults, the primary site of origin [7]. The International Classification of Childhood Cancers (ICCC), based on International Classification of Diseases for Oncology (ICD-O-3) is the standard classification for presentation of international data on childhood cancer incidence and survival [8-10].

Leukemias are the most common amongst the pediatric malignancies, comprising of 30% of all childhood cancers, followed by brain tumors (26%) [2]. However, brain cancer has surpassed leukemia as the leading cause of cancer death among children and adolescents (birth-19 years), because of the dramatic therapeutic advances against leukemia [11].

The pattern of childhood tumors is different in different geographical areas and ethnic groups. Appropriate management of pediatric tumors requires complete epidemiological data in different geographical areas [12].

Hospital registries are an important source of information for assessing the disease pattern in community.

We conducted this institution-based study to give an insight into the pattern of distribution of childhood cancers and to characterize their demographic features.

## MATERIALS AND METHODS

This study is a retrospective study conducted in the Department of Pathology, LLRM Medical College and associated SVBP Hospital, Meerut which is one of the major tertiary health care centres in western Uttar Pradesh region.

A total of 51 cases of pediatric malignancies were collected using five years hospital records from August 2011 to August 2016. All children aged 0-14 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. The records of these tumors were retrieved and analyzed, focussing on the prevalence according to age, sex and types of tumors. For classification of pediatric malignancies in present study, the International Classification of Childhood Cancers (ICCC), based on International Classification of Diseases for Oncology (ICD-O-3), was followed [8-10].

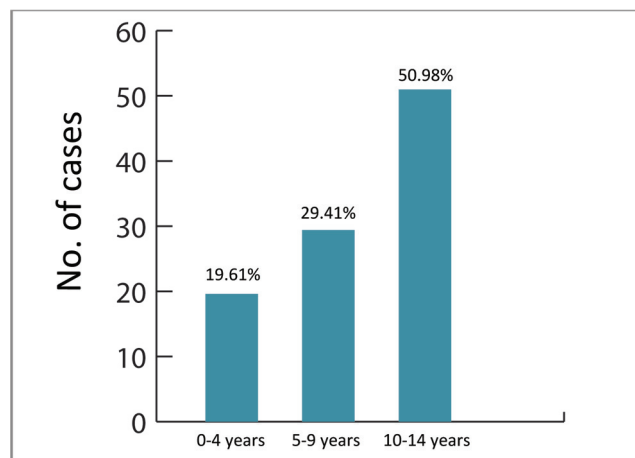
## STATISTICAL ANALYSIS

The results are presented as descriptive statistics.

## RESULTS

**Age-wise Distribution:** Tumors were stratified in different age groups and incidence of pediatric malignancies was recorded in each group [Table/Fig-1]. Out of total 51 cases, maximum number of cases (50.98%;26/51) were seen in 10-14 years age group, followed by 29.41% (15/51) cases in 5-9 years age group and 19.61% (10/51) in 0-4 years. Minimum age in the present study was 3 months and maximum age was 14 years. Mean age of pediatric cancer patients in present study was 9.8 years.

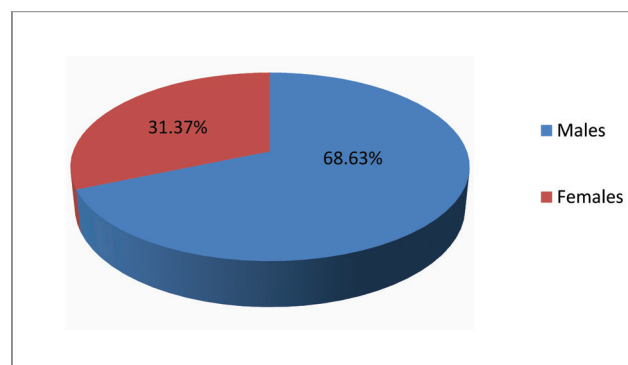
**Sex-wise Distribution:** Males were affected in 68.63%



[Table/Fig-1]: Age-wise distribution of cases.

(35/51) cases, while females were affected in 31.37% (16/51) cases [Table/Fig-2]. Male to female ratio (M:F) observed was 2.2:1.

**Profile of pediatric malignancies:** Childhood malignancies were classified according to ICCC [Table/Fig-3]. Leukemias were found to be the most common pediatric cancers (29.4%;15/51 cases), followed by lymphomas (17.65%;09/51 cases), malignant bone tumors (11.8%;06/51 cases), renal malignancies (9.8%;05/51 cases), brain tumors, soft tissue sarcomas and germ cell tumors (7.8%;04/51 cases each).



[Table/Fig-2]: Sex-wise distribution of cases.

S.No.	Type of Tumors	Number of Cases	Percentage (%)
1	Leukemias	15	29.4
2	Lymphomas	09	17.6
3	CNS Neoplasms	04	7.8
4	Neuroblastoma	01	2.0
5	Retinoblastoma	01	2.0
6	Renal neoplasms	05	9.8
7	Malignant bone tumors	06	11.8
8	Soft tissue sarcomas	04	7.8
9	Germ cell tumors	04	7.8
10	Others	02	4.0
	Total	51	100

[Table/Fig-3]: Profile of childhood malignancies.

When further sub-classified, Acute Lymphoblastic Leukemia (ALL) was the most commonly seen pediatric malignancy [Table/Fig-4]. It accounted for 21.6% (11/51 cases) of total childhood malignancies and 45.8% (11/24 cases) of haematological malignancies. ALL was followed by Hodgkin's Lymphoma and Wilm's tumor (9.8%;5/51 cases each) and Acute Myeloid Leukemia (AML), Non-Hodgkin's Lymphoma (NHL), and Osteosarcoma (7.8%;4/51 cases each). There were 5.9% (3/51) cases of Astrocytoma and 3.9% (2/51) cases each of Ewing's sarcoma of bone and Infantile Fibrosarcoma.

The most common cancer in all three age groups was leukemia [Table/Fig-4]. In <5 years age group, ALL (30%;3/10

S. No.	Types of tumors		0-4 Years	5-9 Years	10-14 Years	Total	Percentage (%)
1	Leukemias	ALL	03	04	04	11	21.6
		AML	-	01	03	04	7.8
2	Lymphomas	Hodgkin's	-	02	03	05	9.8
		Non-Hodgkin's	-	02	02	04	7.8
3	CNS Neoplasms	Astrocytoma	01	-	02	03	5.9
		Medulloblastoma	-	-	01	01	2.0
4	Neuroblastoma		01	-	-	01	2.0
5	Retinoblastoma		01	-	-	01	2.0
6	Renal neoplasms	Wilm's tumor	02	03	-	05	9.8
7	Malignant Bone Tumors	Osteosarcoma	-	-	04	04	7.8
		Ewing's Sarcoma	-	01	01	02	3.9
8	Soft Tissue Sarcomas	Rhabdomyosarcoma	-	-	01	01	2.0
		Extraosseous Ewing's Sarcoma/PNET	-	01	-	01	2.0
		Infantile Fibrosarcoma	02	-	-	02	3.9
9	Germ Cell Tumors	Yolk Sac Tumor	-	01	01	02	3.9
		Dysgerminoma	-	-	02	02	3.9
10	Others		-	-	02	02	3.9
Total			10	15	26	51	
Percentage (%)			19.61%	29.41%	50.98%	100%	

**[Table/Fig-4]:** Distribution of childhood cancers according to age group.

cases) was the predominant malignancy, followed by Wilm's tumor and Infantile fibrosarcoma (20%;2/10 cases each). In 5-9 years age group, ALL comprised of the maximum cases (26.67%; 4/15), followed by Wilm's tumor (20%; 3/15 cases). In 10-14 years age group, both ALL and osteosarcoma accounted for the majority cases (15.38%;4/26), followed by Hodgkin's lymphoma and AML (11.54%;3/26).

## DISCUSSION

Childhood cancers are unique in the sense that they arise from embryonal cells and respond to treatment rapidly [12,13]. They arise mainly in lymphoreticular tissue, CNS, connective tissue and viscera [14]. Childhood cancer incidence appears to be increasing in India [15]. In India, malignancies are coming into greater focus as the major factor contributing to morbidity and mortality in children, surpassing infections and malnutrition because of preventive measures being taken for the later [16].

In the present study, we retrospectively analysed the data regarding demographics and spectrum of malignancies in 51 pediatric patients, during a period of five years.

The distribution of pediatric patients with malignancies was different in the three age groups. Majority belonged to 10-14 years of age (50.98%; 26/51 cases). This was in concordance with the studies of Punia et al.,[14], Jabeen et al.,[17], and Pattnaik et al.,[18]. In contrast, 0-4 years was the most common age group affected in studies of Bhalodia et al.,[12]

Yeole et al.,[19], and Jan M et al.,[20] [Table/Fig-5].

In present study, males were affected in 68.63% (35/51 cases), while females were affected in 31.37% (16/51) cases. M:F ratio was 2.2:1. Male predilection of childhood cancers was also observed in other studies, as evident from [Table/Fig-5]. But M:F ratio in the present study is higher as compared to other studies, except Pattnaik et al.,[18], who found a slightly higher M:F ratio (2.34:1). Our finding of higher incidence in males was also supported by Satyanarayana et al.,[15], who reported the age-adjusted rates ranging from 18.6 to 159.6 per million for boys and 11.3 to 112.4 per million for girls.

Childhood cancers arise in hematopoietic system, central nervous system, soft tissue, bone and kidney more commonly than in adults in whom skin, lung, breast, prostate and colon are the most common sites of tumors [21]. We found that the three most common cancer groups in our study were leukemias (29.4%;15/51 cases), lymphomas (17.65%;09/51 cases) and malignant bone tumors (11.8%;06/51 cases). Bhalodia et al.,[12], Pattnaik et al.,[18], Jan M et al.,[20] and Chaudhuri et al.,[22] also reported leukemia as the most common pediatric malignancy in their studies [Table/Fig-6]. However lymphomas were the most common malignancy in studies done by Jabeen et al.,[17], Mangal et al.,[23], and Devi S et al.,[24]. The incidence of malignant bone tumors in present study was higher than most of the other studies in [Table/Fig-6], except Punia et al.,[14], who reported a much

S. No.	Study	Age distribution (%)			Sex distribution (M:F)
		0-4 years	5-9 years	10-14 years	
1	Bhalodia et al.,[12], 2011	44.18	25.58	30.24	1.38:1
2	Punia et al.,[14], 2014	14.54	31.82	53.64	1.68:1
3	Jabeen et al.,[17], 2010	30.9	31.4	37.7	1.6:1
4	Pattnaik et al.,[18],2012	31.8	24.6	43.6	2.34:1
5	Yeole et al., [19], 2001	36.0	32.0	32.0	1.57:1
6	Jan M et al.,[20], 2015	39.68	30.16	30.16	1.73:1
7	Hazarika et al.,[25], 2014	33.1	34.5	32.4	1.5:1
8	Present study, 2016	19.61	29.41	50.98	2.2:1

**[Table/Fig-5]:** Comparison of age and sex distribution of pediatric malignancies with other studies.

et al.,[12] and Pattnaik et al.,[18] while Jabeen et al.,[17] and Hazarika et al.,[25] found retinoblastoma to be the commonest malignancy in this age group. In 5-9 years age, ALL comprised of the maximum cases (26.67%;4/15), similar to the studies of Pattnaik et al.,[18] and Hazarika et al.,[25]. In contrast, Jabeen et al.,[17] found lymphoma as the most common malignant tumor in children aged 5-9 years. Both ALL and Osteosarcoma accounted for maximum cases (15.38%; 4/26) in 10-14 years age group in present study. Jabeen et al.,[17] found non-Hodgkin's lymphoma while Hazarika et al.,[25] and Pattnaik et al.,[18] found leukemia to be the commonest malignancy in this age group.

Thus, we observed that the pattern of childhood tumors showed wide variation among different age groups. Leukemia was the most common malignancy in all three age groups. Leukemias, lymphomas, brain and bone malignancies occurred more commonly in children above five years of age, while neuroblastoma and retinoblastoma were seen only in children younger than five years.

Types of tumors	Mangal et al., [23] (1991)	Chaudhuri et al., [22] (2003)	Jabeen et al., [17] (2010)	Bhalodia et al., [12] (2011)	Pattnaik et al., [18] (2012)	Punia et al., [14] (2014)	Devi S [24] (2014)	Jan M et al., [20] (2015)	Present study (2016)
Leukemias	26.0	39.1	14.3	44.18	45.5	excluded	10.15	38.1	29.4
Lymphomas	32.0	11.0	24.2	16.27	8.2	7.27	16.16	23.8	17.6
CNS tumors	1.6	-	3.7	6.97	3.6	23.64	6.0	9.5	7.8
Neuroblastoma	13.0	2.0	-	6.97	4.5	0.91	5.64	6.35	2.0
Retinoblastoma	1.2	19.2	17.4	-	5.5	6.36	6.0	4.76	2.0
Renal tumors	16.0	10.0	6.8	9.30	4.5	-	10.15	4.76	9.8
Hepatic tumors	-	-	1.3	-	0.9	-	-	-	-
Malignant bone tumors	-	5.0	7.3	2.32	10.0	32.73	12.41	4.76	11.8
Soft tissue sarcomas	-	11.2	-	2.32	11.8	17.27	11.6	6.35	7.8
Germ cell tumors	5.7	-	3.7	-	4.5	3.64	6.0	-	7.8
Others	4.5	2.5	21.3	11.67	0.9	7.27	15.7	1.59	4.0

**[Table/Fig-6]:** Comparison of spectrum of pediatric malignancies with other studies (%).

higher incidence of bone malignancies (32.73%) in their study.

ALL was the most commonly seen haematological malignancy (45.8%; 11/24 cases). This was in concordance with the studies of Bhalodia et al.,[12], Satyanarayana et al.,[15], Pattnaik et al.,[18] and Hazarika et al.,[25]. Wilm's tumor (18.51%;5/27 cases) was found to be the most common non-hematological malignancy in present study, followed by Osteosarcoma (14.8%;4/27 cases). Bhalodia et al.,[12] also reported Wilm's tumor as the most common non-hematological malignancy.

In <5 years age group, ALL was the predominant malignancy (30%; 3/10). Similar findings were reported by Bhalodia

## LIMITATIONS

The present study is a single institution based study. Small sample size served as a limitation.

## CONCLUSION

This study gives an estimate of the trend of pediatric malignancies in Western Uttar Pradesh region, which is important in the planning and evaluation of health strategies. In India, where there is scarcity of data because of lack of a dedicated pediatric cancer registry, such studies play a major role in effective disease management for this small but important group of patients.

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