

Clinical Spectrum and Outcomes of Pediatric Cancers in Central India: A Study of 189 Cases from a Government State Cancer Institute

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Abstract

Introduction: Childhood cancer is an escalating public health challenge globally, with developing countries like India witnessing a higher incidence of pediatric cancers. Currently, pediatric cancers account for roughly 5% of the overall cancer burden and 10% of childhood deaths. Despite the growing significance, the true incidence of childhood cancers in regions such as Central India remains underestimated due to limited compliance with cancer registries and diagnostic challenges. This study was undertaken to evaluate the clinical spectrum, short-term outcomes, and survival patterns of pediatric cancer patients treated at our state-run tertiary care cancer institute in Jabalpur. The primary aims were to elucidate the demographic profile, analyze the clinical presentations, and determine disease-specific treatment outcomes among children and adolescents (aged 0–18 years) diagnosed with various malignancies.

Materials and Methods: A prospective observational study was conducted over a 2-year period in the Department of Pediatric Hemato-Oncology at our tertiary care institute. Following informed consent, 189 pediatric and adolescent patients diagnosed with malignancies were enrolled in the study. Comprehensive clinical evaluations were performed, which included detailed history taking and physical examination. Diagnostic investigations comprised complete blood counts, peripheral blood smear analysis, and bone marrow aspiration and biopsy, along with advanced diagnostic modalities such as flow cytometry, immunohistochemistry, molecular studies, and cytogenetics. Pediatric malignancies were classified according to the International Classification of Childhood Cancers. All collected data were entered and analyzed using Microsoft Excel. Patients received treatment based on standard protocols, which included chemotherapy, radiotherapy, or surgery, and were subsequently monitored for outcomes such as remission, relapse, or death.

Results: The analysis revealed that hematological malignancies were the most prevalent, constituting 58% of the total cases. Among these, acute lymphoblastic leukemia (ALL) was the most common diagnosis with 72 cases, followed by acute myeloid leukemia with 27 cases. Lymphomas, including Hodgkin's and non-Hodgkin's types, accounted for 8% of the cases. In the domain of solid tumors, neuroblastomas, Wilms' tumor, and Ewing's sarcoma were frequently observed, while central nervous system tumors and bone tumors such as osteosarcoma were less common. The age distribution indicated that leukemia predominated in children aged 2–10 years, whereas solid tumors were more common in older children and adolescents. A clear male predominance was noted (59% males vs. 41% females). Outcome analysis demonstrated that 77.2% of patients were alive at the study's end, while 12.1% abandoned treatment and 10.5% succumbed to the disease.

Conclusion: The study confirms that ALL remains the most prevalent pediatric cancer in our region, underscoring a significant burden of hematological malignancies. There is an urgent need for enhanced awareness among healthcare providers and improved diagnostic facilities. Furthermore, increasing access to specialized pediatric oncology care and establishing robust cancer registries are critical for early detection and timely management. These measures are essential for improving survival outcomes and overall quality of care for pediatric cancer patients in Central India.

Key words: Clinical spectrum, Outcome, Pediatric malignancies

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INTRODUCTION

The incidence of childhood cancer is rising globally, with a notable shift in developing countries such as India, where pediatric morbidity and mortality have traditionally been attributed to malnutrition and infections.^[1] It was found that the Pediatric malignancies are one of the leading causes of

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death in children and adolescents with an incidence rate of approximately 300,000 children of age group 0–19 years old being diagnosed each year.^[1,2] Recent data, however, indicate that pediatric malignancies now contribute to approximately 5% of the total cancer burden and are responsible for nearly 10% of childhood deaths.^[2] As per the report of International Incidence of childhood cancer volume-3 (IICR-3), the age-standardized rate of childhood cancer (0–19 years) incidence in India is 87.3 per million, which is significantly lower than in countries like the US (180 pm), Canada (173.9 pm), and Europe (170–190 pm).^[1] The lower incidence in India could be due to late referral and undiagnosed cases in the rural population. Hence, leading to less diversion of resources for the management of these cases and resulting in poor outcomes in comparison to the western world. The clinical spectrum of pediatric cancers is broad, and these malignancies present unique diagnostic and therapeutic challenges that necessitate specialized care.

This study was designed to evaluate the clinical spectrum, short-term outcomes, and survival patterns of pediatric cancer patients treated at our state-run tertiary care cancer institute in Jabalpur. The primary aim is to delineate the demographic profile, characterize the clinical presentations, and determine the disease-specific treatment outcomes in children and adolescents (aged 0–18 years) diagnosed with various malignancies. The need for such studies is underscored by the growing body of literature emphasizing region-specific differences in pediatric oncology, which may be influenced by factors such as socioeconomic status, environmental exposures, and genetic predispositions. Improved understanding of these factors is essential for developing targeted diagnostic strategies and treatment protocols, which, in turn, could enhance survival outcomes and quality of life for pediatric patients.

Aim

To evaluate the clinical spectrum, short-term outcomes, and survival patterns of pediatric cancer patients treated at our hospital.

Objectives

1. To analyze the demographic profile of pediatric cancer patients, including age, gender, and diagnosis distribution
2. To assess the clinical presentation and disease spectrum of various pediatric malignancies
3. To determine disease specific treatment outcomes of Pediatric malignancies.

MATERIALS AND METHODS

This prospective observational study was conducted for 2 years in the Department of Pediatric Hemato-Oncology

at a government tertiary healthcare State Cancer Institute in Jabalpur. After obtaining written informed consent, all pediatric and adolescent patients diagnosed with malignancies were enrolled in the study. A total of 189 cases were documented.

Following enrolment, a detailed history was taken, and a comprehensive physical examination was performed. All children aged 0–18 years were diagnosed based on necessary investigations, including complete blood count, peripheral blood smear, bone marrow aspiration and biopsy for morphology, flowcytometry, immunohistochemistry, molecular, and cytogenetics.

Patient records were retrieved and analyzed, focusing on the distribution of malignancies by age, sex, and tumor type. Classification of pediatric malignancies in this study followed the International Classification of Childhood Cancers.

For statistical analysis, data were entered into an Excel sheet and analyzed. Patients received supportive and definitive treatment according to standard protocols, including

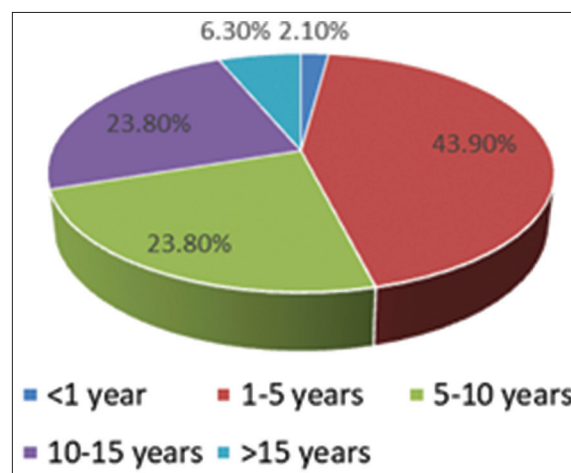


Figure 1: Age-wise distribution of cases

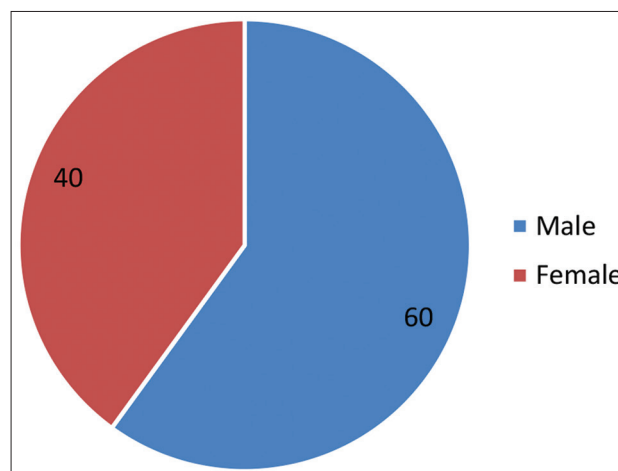


Figure 2: Sex-wise distribution of cases

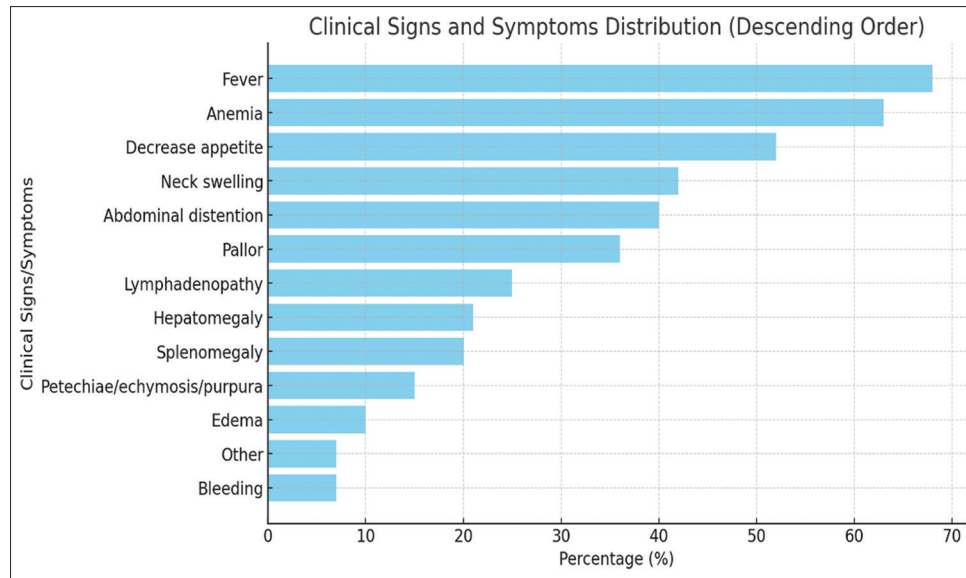


Figure 3: Clinical signs/symptoms of patients in pediatric malignancies in our center

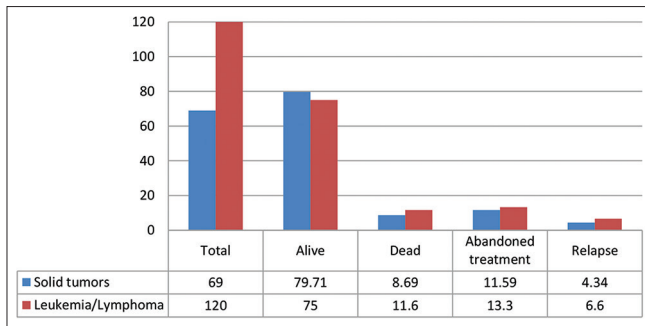


Figure 4: Outcome of pediatric malignancies

Table 1: Age and sex wise distribution of patients in our Centre

Characteristics of patients (n=189)		
Characteristics	No. of patients (n=189)	Percentage
Age distribution (years)		
<1 year	3	2.10
1–5 years	87	43.90
5–10 years	41	23.80
10–15 years	44	23.80
>15 years	14	6.30
Sex-wise distribution		
Male	112	60
Female	77	40
Total	189	100

chemotherapy, radiotherapy, or surgery, based on the type of malignancy. The study outcomes were categorized as remission, relapse, or death.

RESULTS

The study analyzed the spectrum of pediatric cancer cases in Central India, providing insights into the prevalence,

distribution, and trends observed in the region. Out of total 189 majority were male and the most common age of presentation was 1-5 years as shown in Figure 1. The data shown in Table 1 revealed that hematological malignancies constituted the most common category of pediatric cancers, with leukemia accounting for 58% of the total cases. Among leukemias, acute lymphoblastic leukemia (ALL) was the most prevalent (72 cases), followed by acute myeloid leukemia (AML) (27 cases). Lymphomas, including both Hodgkin’s (10 cases) and non-Hodgkin’s lymphoma (5 cases), constituted 8% of the total cases [Table 1].

Solid tumors accounted for a significant proportion of pediatric cancers, with neuroblastomas (9 cases), Wilms’ tumor (10 cases), and Ewing’s sarcoma (9 cases) being the most frequently reported. Central nervous system (CNS) tumors, including medulloblastomas and astrocytomas, were observed in six cases. Bone tumors, such as osteosarcoma (three cases), were relatively less common as reported in our study [Table 1].

Age-wise distribution showed that leukemia was most prevalent in children aged 2–10 years, whereas solid tumors such as osteosarcoma and neuroblastoma were more common in older children and adolescents. Male predominance was observed, with 59% of cases occurring in males and 42% in females.

Clinical characteristics [Figure 2] revealed that fever (68%), pallor (36%), abdominal distention (40%), decreased appetite (52%), and neck swelling (42%) were the most common presenting symptoms. Anemia was seen in 63% of cases, while hepatomegaly (21%) and splenomegaly (20%) were also frequent findings.

Table 2: Disease-wise spectrum of hematological and nonhematological malignancies in pediatric patients in our center

Type of cancer	0–5 Years	6–10 Years	11–15 Years	>15 Years	Total (189)	Total (%)
LEUKEMIA					109	58
Acute lymphoblastic	30	19	14	9	72	
Acute myeloblastic	11	8	7	1	27	
Chronic myeloid leukemia	0	1	3	0	4	
Acute promyelocytic	1	1	3	0	5	
Myelodysplastic syndrome	1	0	0	0	1	
LYMPHOMA					15	8
Hodgkin lymphoma	5	2	3	0	10	
Non-Hodgkin lymphoma	3	0	2	0	5	
Neuroblastoma	7	1	1	0	9	5
Retinoblastoma	5	0	0	0	5	3.00
Wilms tumor	9	1	0	0	10	5.00
Hepatoblastoma	2	0	0	0	2	1.30
Osteosarcoma	2	0	1	0	3	2.00
Ewing sarcoma	2	1	4	2	9	5
Rhabdomyosarcoma	4	1	1	0	6	3
Germ cell tumor	4	2	3	0	9	5
OTHERS	1	1	2	2	6	3
CNS tumor	3	3	0	0	6	2.00
Total	90	41	44	14	189	100.00

Table 3: Clinical characteristics of patients in pediatric malignancies in our center

Clinical signs/symptoms	No. of patients	Percentages
Fever	120	68
Pallor	65	36
Bleeding	12	6.80
Abdominal distention	69	40
Decrease appetite	92	52
Neck swelling	74	42
Anemia	112	63
Hepatomegaly	38	21
Splenomegaly	34	20
Lymphadenopathy	44	25
Edema	16	10
Petechiae/echymosis/purpura	25	15
Other	13	7

Risk stratification data as depicted in Table 2 showed that among ALL patients, 26 were classified as standard risk, 35 as intermediate risk, and 11 as high risk. Similarly, AML cases had 6 standard-risk, 15 intermediate-risk, and 6 high-risk patients. Tumor staging showed a higher proportion of advanced-stage cases in non-hematological malignancies, with neuroblastoma and rhabdomyosarcoma cases primarily diagnosed at stages 3 and 4.

Outcome analysis as shown in Figure 3 indicated that 77.2% of patients were alive at the end of the study, 12.1% had abandoned treatment, and 10.5% had succumbed to the disease. The relapse rate was 5.8%. Disease-specific outcomes as shown in Tables 3 and 4 revealed that ALL had a survival rate of 56 out of 72 cases, while AML had 20 survivors out of 27 cases. Among solid tumors, Wilms' tumor, germ cell tumors, and Ewing sarcoma had

relatively better outcomes compared to hepatoblastoma and neuroblastoma in our study [Figure 4, Tables 5 and 6].

DISCUSSION

The findings of this study align with both global and national trends in pediatric oncology, where leukemia—particularly ALL—remains the most prevalent cancer in children.^[2,3] The high incidence of hematological malignancies underscores the need for targeted diagnostic and treatment strategies, including improved access to bone marrow transplantation and advanced therapies.^[3,4]

The observed frequency of CNS tumors highlights the necessity of early diagnosis and specialized neuro-oncology care.^[5] Delayed diagnosis remains a significant concern, often leading to poorer prognoses.^[6] Strengthening imaging facilities and enhancing awareness among primary healthcare providers could facilitate earlier detection and improve clinical outcomes.^[6,7]

The predominance of male patients across various cancer types is consistent with established epidemiological trends.^[2,8] This disparity may be attributed to factors such as genetic susceptibility, environmental exposures, or sociocultural influences on healthcare-seeking behavior.^[3] In many regions, boys tend to receive greater medical attention, which may contribute to the higher reported incidence in males.^[8]

Our data emphasize the urgent need for comprehensive pediatric oncology care in Central India, including enhanced

Table 4: Risk stratification and stages of pediatric malignancies

Type of leukemia	Standard risk	Intermediate risk	High risk	
Acute lymphoblastic	26	35	11	
Acute myeloblastic	6	15	6	
Chronic myeloid leukemia	Chronic phase	Blast crisis		
No of cases	5	0		
Acute promyelocytic leukemia	Standard risk	High risk		
No of cases	4	1		
Type of tumor	Stage 1	Stage 2	Stage 3	Stage 4
Hodgkin lymphoma	0	4	6	0
Non-Hodgkins lymphoma	0	3	2	0
Neuroblastoma	0	0	6	3
Retinoblastoma	1	1	0	3
Wilms tumor	0	2	7	1
Hepatoblastoma	0	0	1	1
Germ cell tumor	0	2	3	1
Rhabdomyosarcoma	0	3	4	2
Medulloblastoma	0	0	2	2
Pilocytic astrocytoma	0	1	0	0
Bone tumor	Localized	Metastatic		
Osteosarcoma	2	1		
Ewings	6	3		

Table 5: Outcome of pediatric malignancies in our center

Outcome table			
Alive	146/189	77.2%	
Abandoned treatment	23/189	12.1%	
Death	20/189	10.5%	
Relapse	11/189	5.8%	

Table 6: Disease-specific outcome of pediatric malignancies

Type of tumor	Total Alive Dead Abandoned Relapse treatment				
	189	146	20	23	11
Leukemia/lymphoma					
Acute lymphoblastic	72	56	8	8	3
Acute myeloblastic	27	20	2	5	4
Chronic myeloid leukemia	4	4	0	0	0
Acute promyelocytic	5	4	1	0	0
Myelodysplastic syndrome	1	1	0	0	0
Hodgkin lymphoma	10	6	2	2	1
Non-Hodgkin lymphoma	5	3	1	1	0
Neuroblastoma	7	5	1	1	0
Retinoblastoma	5	5	1	0	0
Wilms tumor	10	7	1	2	0
Hepatoblastoma	2	1	1	0	0
Osteosarcoma	9	6	1	2	1
Ewing sarcoma	9	8	0	1	2
Rhabdomyosarcoma	6	5	0	1	0
Germ cell tumor	9	8	1	0	0
CNS tumor	6	5	0	1	0
Unclassified	6	6	0	0	0

CNS: Central nervous system

diagnostic facilities, improved access to advanced treatment options, and long-term survivorship programs.^[4,7] Future research should focus on identifying region-specific risk factors and assessing the efficacy of current therapeutic approaches to improve survival rates and quality of life for pediatric cancer patients.^[6,7]

Childhood malignancies exhibit distinct characteristics compared to adult cancers, with epithelial tumors being rare.^[9] Most pediatric tumors originate from the lymphoreticular system, CNS, and connective tissues. At NSCB Medical College, 189 cases of pediatric malignancies were diagnosed over 1 year. The observed male-to-female ratio of 1.4:1 indicates a higher incidence of malignancies in males, a finding that is consistent with previous reports by Yeole *et al.*^[2] Joshi *et al.*^[3] and Malhotra *et al.*^[4]

In our study, children aged 0–5 years accounted for the largest proportion of cases in both leukemia and malignant solid tumor groups, which is consistent with findings reported by Bhalodia and Patel.^[8] and Jabeen *et al.*^[1] Among the 11 types of malignant tumors analyzed, adolescents aged 15–18 years exhibited the lowest incidence. ALL and embryonal tumors—such as neuroblastoma, nephroblastoma, rhabdomyosarcoma, and hepatoblastoma—were most prevalent in children under 5 years of age, with ALL peaking at 2 years.^[1]

Hematological malignancies were more common than non-hematological malignancies, a trend also noted by

Priyadarshini *et al.*^[6] and Bhalodia and Patel.^[8] Acute leukemia accounted for the highest proportion (56%) of cases, consistent with the findings of studies by Chauhan *et al.*^[10] and others. This was followed by lymphomas (both Hodgkin's and non-Hodgkin's) and Wilms tumor. Among nonhematological malignancies, Wilms tumor was the most commonly observed, aligning with the study by Malik.^[9]

The etiology of childhood cancers remains largely unknown, although several genetic and environmental factors have been implicated.^[4] These factors include maternal use of oral contraceptive pills, ionizing radiation exposure during pregnancy, pesticide exposure, parental occupation, and smoking. Environmental risk factors, such as air pollution and radiation exposure, also contribute to the incidence of childhood cancers.^[5] The higher occurrence of malignancies in rural populations in our study area may be linked to low socioeconomic status and poor hygiene. Globally, the incidence of childhood cancers varies based on age, gender, ethnicity, socioeconomic status, and geography, emphasizing the need for region-specific research and tailored healthcare interventions.^[4,5]

Abandonment of treatment and poor compliance are critical issue, as shown in a SIOP report.^[11] In our study 24 patients could not be retrieved due to the poor prognosis explained to them or misconception of the disease being incurable in nature as told by their close contacts. Arora *et al.*^[12] The problem of abandonment in developing countries was also elaborated by Arora *et al.* and have also suggested ways to improve treatment adherence.^[12]

CONCLUSION

While this single-institution study cannot determine the exact incidence rate of pediatric malignancies, it provides

valuable insight into their distribution patterns in this region. ALL remains the most common pediatric cancer, as consistently reported in multiple studies. However, the incidence of other childhood malignancies is also rising. The primary focus should be on increasing awareness among caregivers and healthcare providers to facilitate early detection and diagnosis. In addition, efforts should be made to improve access to pediatric cancer care services, particularly beyond major urban Centers.

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