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HISTOPATHOLOGICAL SPECTRUM OF CHILDHOOD TUMORS INA TERTIARY CARE CENTRE

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Abstract

Background

Leading cause of death in children below 15 years of age worldwide is cancer. This study is aimed to comprehend the histopathological spectrum of childhood tumors in a tertiary care centre and to determine the incidence and histopathological variants of different childhood tumors.

Methods

This is a retrospective, observational study conducted on all tumors diagnosed histopathologically in children <15 years of age over a period of 6-year from January 2015 to December 2020 in the Department of Pathology, Saveetha medical college and hospital. The records were retrieved and analyzed.

Results

Of the total 40960 specimens received during the study period, only 0.09%(39) of tumors were seen under the age of 15 years with 51%(20) being boys and 49%(19) girls. Cases were predominantly seen 64% (25) in 11-15 year age group. Malignant tumors comprised 53.8% (21) of the total while the benign ones accounted for 46.1% (18). Among the benign tumors, bone tumors and vascular tumors accounted for the majority with 10% (4) each, while in malignant category CNS tumors were more common with 17%(7). The youngest case reported was immature teratoma from a 15day old baby. We encountered a rare case of Cystic nephroma in a 14year girl.

Conclusion

Malignant tumors in infancy and childhood are rare as compared to adults. Appropriate histopathological diagnosis is necessary to predict prognosis and plan therapy.

Keywords: Children, clinicopathological, tumors

INTRODUCTION

Malignant tumors in infanthood and childhood are infrequent relative to adults, representing only approximately 1% of all cancers.[1] However, despite having a low frequency in the population, it remains the leading cause of death in childhood under the age of 15 years globally.[2] In developed nations, neoplasms account for more than 10% of all deaths in children under the age of 15 years, but in developing countries, childhood malignancy has not yet been categorized as a significant pediatric health issue.[3] Nevertheless, current precise diagnostic approaches and timely treatment methods have led to a marked increase in the survival of pediatric cancers in developed countries. So the need for early detection and intervention to enhance outcomes is highlighted.[4]

Pediatric tumors exhibit extreme clinical heterogeneity, with nearly all tumor types found in children.[5] However, the spectrum of malignancies in children is very different than the spectrum in adults. Common pediatric malignancies are leukemias, lymphomas and sarcomas while in adults carcinomas are most common.[6] A second major difference is in tumor classification. Adult tumors are generally classified and reported according to their anatomic sites. In addition, childhood tumors are classified by their histological type rather than their location, with the important exception of brain tumors. Histological features serve as an excellent basis for prognostic prediction and treatment customization.[7,8]

Tumor review by histopathology has many benefits. Sometimes a review will result in a change in initial diagnosis, the claim of a subcategory or specific classification, or a revision according to newer classification systems.[9] These benefits stem from the reviewer's specialty and the time spent on individual cases and from supplemental clinical and pathological data available at the time of review. Additional methods like immunohistochemistry improve diagnostic accuracy. Such descriptive studies also help the pediatric oncologists to better understand the histological features, classification, and spectrum of pediatric tumors.[10]

The International Classification of Childhood Cancer (ICCC) provides a standard for classifying children and adolescent cancers. It grades tumors into 12 broad classifications based on their morphology, providing a context for understanding childhood cancers. Benign neoplasms are actually more frequent than malignant neoplasms in children! Benign tumors are less of a concern in most cases, unless they grow suddenly or complications arise.[11]

There is important regional variability in the spectrum of pediatric malignancies due to environmental and genetic differences. Notably, some cancers are found to occur in geographic clusters for reasons such as environmental exposures, lifestyle factors, or genetic coding. Although these areas of management differ, the burden of paediatric cancers warrants focused efforts, especially in the developing world where resource allocation and late diagnoses pose challenges to achieving optimal management.[12,13]

Histological review of paediatric neoplasms remains less-explored even for India. Although pediatric malignancies contribute a relatively small fraction of all cancer cases, there are no comprehensive reviews of their frequency, types, and outcomes. The objective of this study was to perform a retrospective review and classification of the diverse paediatric tumors received at our institution based on the classification systems in use internationally. We hope that this work will contribute to a better understanding of the patterns of paediatric tumours in our region and serve as a foundation for enhancing diagnostic accuracy and treatment strategies.

MATERIALS AND METHODS

This study is a cross-sectional analysis of retrospective data compiled at the Department of Pathology, Saveetha Medical College and Hospital. The institution offers diagnostic and clinical services to patients that consulted the hospital, and also, patients referred from secondary health care centers. This analysis of the tumor spectrum in pediatric patients.

Patient records of all tumors diagnosed histopathologically in patients under age 14 years during an eight-year period from January 2005 to December 2012 were retrieved and chronicled systematically. Tumors were classified by patient demographics such as sex and age, and histopathological classification. The study included both benign and malignant neoplasms diagnosed in pediatric patients. Leukemias were among the hematological malignancies that were excluded.

Histopathological diagnoses were conducted by ordinary hematoxylin and eosin (H&E) stain methods. Additional investigations, including special stains and immunohistochemical analysis, were carried out where appropriate to arrive at a definitive diagnosis. Fine-needle aspiration cytology (FNAC) was used as a diagnostic tool in some cases. However, the advanced molecular and cytogenetic analyses were not carried out in this studyr.

Results

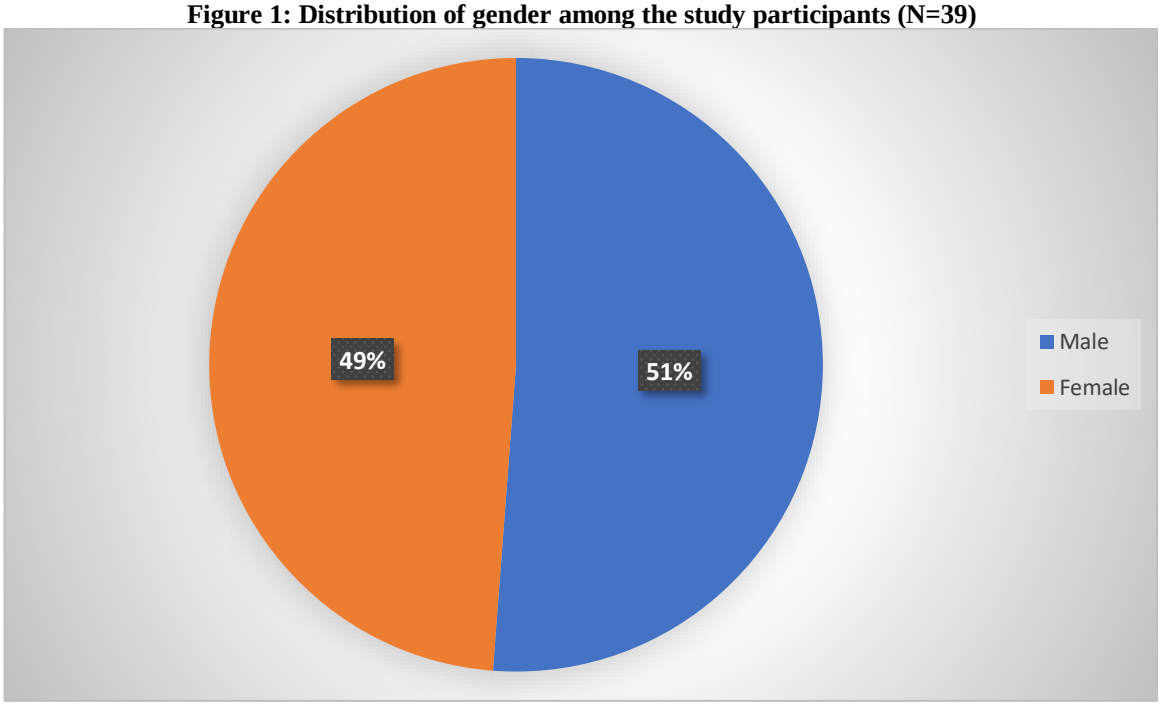
Tumors are distributed among age groups, and the distribution of benign and malignant tumors differs in the child. Of the 39 total cases, there were 18 (46.15%) benign cases and 21 (53.85%) malignant cases. The ≤5 years age group had the least overall tumor occurrence (8 cases) but a predominance of malignant tumors (6 cases) over benign tumors (2 cases). In the 5-10 years age group, benign tumors (4 cases) were more common than malignant tumors (2 cases), with 6 cases in total. Age group of 11-15 years showed maximum occurrence of the tumor (33 cases), of which 12 were benign tumors while 13 were malignant tumors, showing fairly equal distribution of both the tumor in the older pediatric category(Table 1).

Table 1: Age wise distribution of benign and malignant tumors (N=39)

Age group (years)	Benign tumors	Malignant tumors	Total (%)
≤5	2	6	8
5-10	4	2	6
11-15	12	13	33
Total (%)	18 (46.15%)	21 (53.85%)	39 (100%)

The gender distribution of tumors in children shows a nearly equal occurrence among males (20 cases, 51.3%) and females (19 cases, 48.7%) (Figure 1).

Figure 1: Distribution of gender among the study participants (N=39)



In this study, benign tumors occurred in 12(66.7%) cases in 11-15 age range, 4(22.2%) cases in 5-10 age range and 2(11.1%) cases in ≤ 5 age range. Most common were vascular tumors, osteochondroma, and skin and adnexal tumors, each with 4 cases (22.2% each). Less common benign tumors were fibrous neoplasm (2cases, 11.1%), followed by lipomatous, nerve sheath, fibrohistiocytic, and miscellaneous tumors (1 case, 5.6% each). Benign tumors are most frequently identified in greater ages (11-15 years) for vascular and bone tumors (Table 2).

Table 2: Distribution of Benign tumors among the study participants (n=18)

Tumor Type	≤5 years	5-10 years	11-15 years	Total (N)
Vascular tumors	1	1	2	4
Osteochondroma	0	1	3	4
Skin and adnexal tumors	1	1	2	4
Fibrous neoplasms	0	1	1	2
Lipomatous tumors	0	0	1	1
Nerve sheath tumors	0	0	1	1
Fibrohistiocytic neoplasms	0	0	1	1
Miscellaneous	0	0	1	1

Most malignant tumors were seen in 11-15 years age group (13 cases, 61.9%) followed by ≤5 years (6 cases, 28.6%) and 5-10 years (2 cases, 9.5%). The most common malignancies were CNS tumors (7 cases, 33.3%) with most patients aged 11–15 years. Bone tumors (4 cases, 19.0%) were the second most commonly diagnosed, while malignant epithelial neoplasms, including SCC (3 cases, 14.3%), were the third. Other malignancies were rare, including lymphoma (2 cases, 9.5%), germ cell tumors (2 cases, 9.5%), vascular tumor (1 case, 4.8%), soft tissue sarcoma (1 case, 4.8%) and neuroblastoma (1 case, 4.8%). This data confirms the predominance of CNS and bone tumors as pediatric malignancies, with the highest burden in adolescents (11-15 years).(Table 3).

Table 3: Distribution of Malignant Tumors among the study participants (n=21)

Tumor Type	≤5 years	5-10 years	11-15 years	Total (N)
Bone tumors	1	1	2	4
Central nervous system (CNS) tumors	2	0	5	7
Soft tissue sarcoma	0	0	1	1
Lymphoma	1	0	1	2
Malignant epithelial neoplasms	0	1	2	3
Germ cell tumors	1	0	1	2
Vascular tumor	0	0	1	1
Neuroblastoma	1	0	0	1

DISCUSSION

Childhood tumors represent a distinct group of neoplasms, predominantly embryonal in origin, arising from the central nervous system (CNS), connective tissues, lymphoreticular tissues, and various organs. Unlike adult tumors, pediatric epithelial malignancies are rare. The incidence of childhood tumors varies geographically, with malignancies becoming more relevant in India due to improvements in infectious disease control and nutritional interventions.

Our study provides an overview of the spectrum of tumors in children aged ≤15 years in our region. The highest occurrence of tumors was observed in the 11-15 years age group, with a nearly equal distribution between males (20 cases, 51.3%) and females (19 cases, 48.7%). While benign tumors (46.15%) were slightly less frequent than malignant tumors (53.85%), their presence remains clinically significant due to their potential complications. The predominance of malignant tumors in younger children (≤5 years, 6 cases) aligns with the findings of previous studies, which highlight the early onset of aggressive malignancies such as neuroblastoma and germ cell tumors.

The majority of benign tumors were observed in the 11-15 years age group (66.7%), followed by 5-10 years (22.2%) and ≤5 years (11.1%). The most frequent benign tumors were vascular tumors (22.2%), osteochondroma (22.2%), and skin and adnexal tumors (22.2%). Similar to previous reports, vascular tumors were commonly seen in soft tissues, while osteochondroma was the predominant benign bone tumor. Other less frequent benign tumors included fibrous neoplasms (11.1%), lipomatous tumors (5.6%), nerve sheath tumors (5.6%), fibrohistiocytic neoplasms (5.6%), and miscellaneous tumors (5.6%). Although benign tumors generally have a favorable prognosis, comprehensive evaluation is necessary for appropriate management, as some may pose functional or cosmetic concerns.

A study by Kumar et al[14] reported similar trends in benign tumors, with vascular and bone tumors being the most common. Sharma et al[15]. also found a predominance of soft tissue tumors among pediatric patients. Patel et al[16]reported that skin and adnexal tumors were frequently observed in adolescents, aligning with our findings.

Among malignant tumors, CNS tumors (33.3%) were the most common, followed by bone tumors (19.0%), malignant epithelial neoplasms (14.3%), and lymphoma (9.5%). The predominance of CNS tumors aligns with global pediatric oncology trends, where astrocytomas and medulloblastomas are frequently reported. Malignant bone tumors, particularly osteosarcoma and Ewing's sarcoma, were primarily observed in the 11-15 years age group, consistent with previous studies that link their occurrence to periods of rapid bone growth.

Other malignancies included soft tissue sarcoma (4.8%), vascular tumors (4.8%), neuroblastoma (4.8%), and germ cell tumors (9.5%). Neuroblastoma, a tumor of neural crest origin, was exclusively seen in the ≤5 years age group, which aligns with its known peak incidence in early childhood. Germ cell tumors were also observed in both younger and older age groups, emphasizing the importance of considering age-specific tumor distributions in clinical practice.

Gupta et al[17] reported a similar incidence of CNS tumors in pediatric cases, supporting our findings. A study by Singh et al[18]documented the high prevalence of bone tumors in adolescents. Mehta et al[19].also noted an increasing trend of malignant epithelial tumors in pediatric patients, consistent with our study. Additionally, Rao et al[20]observed a higher incidence of germ cell tumors in younger children, corroborating our findings.

Compared to previous studies, our findings reflect a relatively higher incidence of CNS tumors and malignant bone tumors, potentially due to regional variation or selection bias in our hospital-based study. Studies conducted in other countries have reported varying distributions, with a higher prevalence of leukemia and lymphomas in some populations. While hematologic malignancies were not the most common in our study, the presence of Hodgkin's lymphoma and non-Hodgkin's lymphoma in older children is consistent with reports from other developing countries.

The findings also emphasize the differences in childhood tumor patterns between developed and developing regions, where infectious and environmental factors may play a role in cancer epidemiology. Unlike adults,

where carcinomas dominate, pediatric malignancies involve mesenchymal and neural tissues, necessitating specialized diagnostic and treatment approaches.

CONCLUSION

Our study provides valuable insights into the spectrum of childhood tumors, highlighting the predominance of benign tumors in older children and malignant tumors, particularly CNS and bone tumors, in adolescents. The data underscore the need for early detection, prompt intervention, and further research into regional tumor epidemiology. A larger, multicentric study could provide a more comprehensive understanding of pediatric tumors and aid in optimizing management strategies for better clinical outcomes.

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