



HISTOPATHOLOGICAL SPECTRUM OF PEDIATRIC TUMOURS : A FIVE YEAR CROSS SECTIONAL STUDY IN A TERTIARY CARE CENTRE

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ABSTRACT **Background:** Pediatric malignancies are one of the most common causes of childhood morbidity and mortality and are as diverse as those in adults and present a number of challenges for the pathologist. The aims and objectives are to study the clinical and histomorphological features of all pediatric tumors and categorize them as benign and malignant lesions. To compare the patterns of different tumors with other established studies and understand the epidemiology in our region. **Methodology:** This study is a cross sectional study conducted in the Department of Pathology at a tertiary care centre, which caters to the patients attending and referred from periphery. The records of all the tumours diagnosed histopathologically in children <18 years of age during a period of 5 years from July 2017 to June 2022 are retrieved and analyzed. **Results:** A total of 160 tumors were seen in the age range of 2days to 18 years, with 52.50% (84) occurring in boys and 47.50% (76) in girls. Benign tumors outnumbered [83.75% (n= 134)] the malignant tumors [16.25% (n= 26)] . In the benign tumors, vascular tumors were most common, while in malignant category CNS tumors were most common. **Conclusion:** Pediatric oncology needs a much collaboration and a vigorous effort to reach International standards. This study is an attempt to provide a complete spectrum of childhood tumors diagnosed on histopathology which includes both benign and malignant tumors, while most of the previous studies have mainly focused on malignant tumors in children

KEYWORDS : Pediatric, Malignant, Benign, morbidity.

INTRODUCTION:
Tumors that occur in children are as diverse as those in adults and present a number of challenges for the pathologist [1]. Compared with cancers that occur in adults, childhood cancers are rare comprising only 1% of all the cancers [2]. Although rare, pediatric malignancies are one of the most common causes of childhood morbidity and mortality. Benign tumors are more common than the malignant tumors. Most benign tumors are of little concern but on occasion they cause serious disease by virtue of their location or rapid increase in size [3]. Both benign and malignant tumors need a comprehensive evaluation to provide an appropriate diagnosis for designing therapy and predicting prognosis. Both benign and malignant tumours require a thorough evaluation to provide an appropriate diagnosis for determining a treatment plan and prognosis [4].

The aims and objectives are to study the clinical and histomorphological features of all pediatric tumors and categorize them as benign and malignant lesions; and to comprehend the epidemiology in this region, by comparing the patterns of various malignancies with other well-established studies.

METHODOLOGY:
The current study is a descriptive cross sectional study conducted in the Department of Pathology, Alluri Sita Ramaraju Academy of Medical Sciences, a tertiary care centre, which caters to the patients attending and referred from periphery. The records of all the tumours diagnosed histopathologically in children <18 years of age during a period of 5-years from July 2017 to June 2022 were retrieved and analyzed. The tumors were analyzed according to the age, sex and histopathological diagnosis. Both benign and malignant tumors diagnosed in children were included, while leukemias were excluded from the study. The clinical details were provided by the respective clinical departments. Sections were prepared from formalin fixed, paraffin embedded blocks and stained with Hemotoxylin and Eosin in all cases. All tumors were diagnosed on routine hematoxylin and eosin stained sections; special stains were applied

wherever necessary. Fine-needle aspiration was done in some cases only. Cytogenetic and molecular studies were not done for any of the cases. The tumours were classified according to recent WHO classification of tumors in respective systems and International Classification of Childhood Cancer (ICCC).

Ethical approval was obtained from ethics and institutional review committee of the hospital with Approval no: IEC/ASR/APPROVAL/40/2021.

RESULTS AND OBSERVATIONS:
During the 5-year study period, a total of 160 paediatric tumors diagnosed on histopathology were studied. The cases included were in the age range of 2days -18 years with 52.50% (84) occurring in boys and 47.50% (76) in girls. Maximum number of cases were seen in the age group of 10-14 years. The system wise distribution of these tumors is shown in fig1.

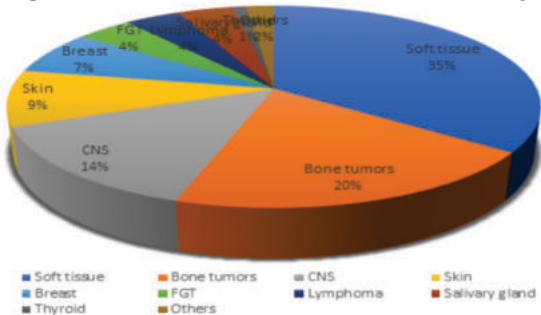


Fig 1: System wise distribution of Pediatric solid tumors
CNS- Central Nervous System, **FGT**- Female Genital tract
Fig 2: Benign and malignant pediatric solid tumors

S.no	Diagnostic group	Benign	Malignant
1.	Soft tissues	33%	2%
2.	Bone tumors	19.5%	0.5%
3.	CNS	8%	6%
4.	Skin	8.5%	0.5%
5.	Breast	7%	0
6.	FGT	4%	0

7.	Lymphoma	0	4%
8.	Salivary gland	3.5%	0.5%
9.	Thyroid	0	1%
10.	others	0.5%	1.5%
11.	Total	84% (134)	16% (26)

As depicted in Table 1, soft tissue tumors were the most common which include predominantly vascular tumors comprising of 23% followed by Lipomas (6%), nerve sheath tumors including Neurofibroma, tenosynovial giant cell tumors, a case of Desmoid tumor and Deep fibrous histiocytoma. Bone tumors were the next common tumors. Osteochondroma was the most common bone tumor comprising of 13% followed by aneurysmal bone cyst, a case of osteoid osteoma and fibro-osseous dysplasia - a tumor like lesion. Benign tumors of Central Nervous system include craniopharyngioma, astrocytoma, meningioma and pinealoblastoma.

The spectrum of benign tumors of skin and adnexae included Pilomatricoma, Dermoid cyst, Compound nevus, Nevus sebaceous and Eccrine angiomatous hamartoma. Fibroadenoma was seen to occur exclusively in females >12 years of age. All female genital tract tumors were ovarian tumors and predominantly include serous cystadenomas followed by mucinous cystadenoma and a case of mature cystic teratomas. Current study also included pleomorphic adenoma (benign salivary gland neoplasm) and a case of squamous odontogenic tumor.

Fig 3: Age wise distribution of benign neoplasms

S.no	Diagnostic group	< 1yr	2-5 yr	6-10yr	11-14yr	14y-18yr	Total
1.	Soft tissues	2	4	13	22	15	56
2.	Bone tumors	-	-	5	11	12	28
3.	CNS	1	2	4	1	4	12
4.	Skin	-	3	2	4	5	14
5.	Breast	-	-	-	4	7	11
6.	FGT	-	-	-	1	6	7
7.	Salivary gland	-	-	-	2	3	5
8.	others	-	-	-	1	-	1
9.	Total	3	9	24	46	52	134

In the present study CNS tumors were the most common malignant tumors and predominantly include Medulloblastoma and a case of Astrocytoma – Grade 3 and Anaplastic ependymoma, followed by lymphomas predominantly Hodgkin's lymphoma and a case of Non Hodgkin lymphoma.

The category of soft tissue and bone tumors include Ewing sarcoma/PNET and a case of Osteosarcoma and Embryonal Rhabdomyosarcoma. The category of malignant tumors in head and neck include Papillary carcinoma thyroid and a case of Mucoepidermoid carcinoma of parotid gland Others include Wilms tumor and Immature sacrococcygeal teratoma.

Benign tumors were seen in the age group of late childhood (10 to 14 yrs) and adolescents (15 to 18 yrs), where as malignant cases are seen predominantly in early childhood (2-5yrs).

Fig: 4 Age distribution of malignant neoplasm

S.n	Diagnostic group	0 - 29 days	29 days - 1yr	2-5 yr	6-10 yr	11-14yr	14 - 18 yr	Total
1.	Soft tissues		1	1		1		3
2.	Bone tumors					1		1
3.	CNS			6	4			10
4.	Skin					1		1
5.	Lymphoma			1	1	3	1	6
6.	Salivary gland					1	-	1
7.	Thyroid					1	1	2

8.	others	1	-	1	-	-	-	2
9.	Total	1	1	9	5	8	2	26

DISCUSSION

Childhood tumors form a highly specific group, are mainly embryonal in type and arise in the lymphoreticular tissue, CNS, connective tissue and viscera. Unlike adults, epithelial tumors are rare [5]. The incidence and frequency of childhood tumors has a great geographical variability. In India, although infections and malnutrition are the major factors contributing to morbidity and mortality, malignancies are coming into greater focus because of preventive measures being taken for the infectious and nutritional disorders [6]. Even with neoplasia assuming greater importance as a major cause of infant and child mortality in the Indian subcontinent, there is paucity of published material from India on the histologic review of tumors in this age group [7].

Present study attempts to provide a spectrum of tumors in children <18 years of age in our region. Maximum number of childhood tumors were seen in the age group of 15-18 years in the current study, showing a slight variation with study conducted by Punia, et al [8] which showed maximum tumors in age group of 10 – 14yrs. Male predominance is a salient feature of many childhood tumors as depicted in studies like Sharma et al, Kusumakumary et al, Banerjee et al, which was correlated with the present study [1,5,6]. Benign tumors were usually more common than malignant tumors similar to Lee et al. and Punia et al. study [8, 9].

In the current study, malignant tumors accounted for 16.25% cases. This mandates a comprehensive evaluation for appropriate management and a need to study their spectrum in children [10]. Due to a paucity of data on spectrum of benign tumors comparison was done with present findings with Lee et al. and Punia et al. study [8, 9].

Table 5: Comparision of benign tumors with other studies

Tumor	Lee et al. (%) 1996	Punia, et al. (%) 2014	Present study (%)
Vascular tumors	23.29	24.73	23.75
Bone tumors	7.60	22.55	20.00
Lipomatous tumors	5.26	8.73	6.25
Skin and adnexal tumors	26.31	8.36	8.75
Breast neoplasms	5.26	8.73	6.87
FGT	-	-	4.37
Nerve sheath tumors	8.77	5.09	1.87
Fibrohistiocytic tumors	-	2.91	3.12
others	12.3	9.45	3.75

Table 6: Comparison of malignant tumors with other studies

Tumor	Banerjee et al. 1986 (%)	L.jungman et al. 2011	Punia, et al. (%) 2014	Present study (%)
CNS tumors	15.3	-	23.64	38.46
lymphomas	25.9	21.9	7.27	23.07
Malignant Bone tumors	10.5	9.4	32.73	3.84
Soft tissue and other extra osseous sarcomas	14.3	14.5	17.27	11.53
Germ cell tumors	3.8	10.9	3.64	3.84
Renal tumors	8.5	14.7	-	3.84
Malignant epithelial neoplasms and malignant melanoma	5	-	7.27	15.38

The majority of soft tissue tumors in young adults are benign vascular or fibroblastic proliferations similar to Malone M et al. study [11]. Majority of breast masses in the pediatric age group are benign, Fibroadenoma being the most frequent breast tumor in adolescent girls [12] which is in compliance with present study. Pilomatricoma, a neoplasm of hair germ

matrix origin, is one of the most common cutaneous appendage tumors in younger age group. Similar to Demircan M et al, Punia et al studies, present study also showed a predilection of this tumor for the head and neck region and the upper extremities [13].

The most frequent childhood cancers arise in the hematopoietic system, nervous tissue, soft tissue, bone and kidney. This is in contrast to adults in whom the skin, lung, breast, prostate and colon are the most common sites of tumors [3].

Childhood cancer comprises a variety of malignancies with incidence varying worldwide by age, sex, ethnicity and geography. Compared with other studies present study has a higher incidence of CNS tumors, lymphomas. This could probably be due to regional variation or because of selection bias, as the study being a tertiary hospital-based study.

Diagnosis of bone tumors requires correlation of clinical, radiographic and pathologic findings as it is difficult for pathologists to accurately classify bone tumors histopathologically because of the low incidence and tumor heterogeneity [14]. In this study, medulloblastoma and astrocytoma were the most common CNS tumors. The analysis based on data collected by the Manchester Children's Tumor Registry during a 45-year time period (1954-1998) revealed 2511 non-lymphoreticular solid tumors, of which 1055 were CNS tumors, astrocytoma being the most common [15].

HL was seen more commonly in present study than NHL and was most frequent in the 10-14 years age group. Banerjee et al. [6] also reported a similar trend. Rhabdomyosarcoma comprises the most common soft tissue sarcoma among children and adolescents and frequently occurs in the head and neck region. Similar location was seen in this study in compliance to Parham et al study [16].

Mucoepidermoid carcinoma is the most common malignant salivary neoplasm in adults, it occurs rarely in the pediatric age group. However, current study included a case of Low grade mucoepidermoid carcinoma in 15 yrs girl similar to Conley et al study [17].

Early childhood, 2 – 5 years cohort were found to have the highest prevalence of malignant tumours while 14 -18yrs (late childhood and adolescents) had the highest prevalence of benign tumours. Some authors also reported similar findings in their study. The reason for more prevalent malignant tumours among the under-5 may not be very apparent. However genetic and several environmental factors have been linked as risk factors for many cases of childhood malignancies.

CONCLUSION:

Pediatric oncology needs a much collaboration and a vigorous effort to reach International standards. This study is an attempt to provide a complete spectrum of childhood tumors diagnosed on histopathology which includes both benign and malignant tumors, while most of the previous studies have mainly focused on malignant tumors in children. Molecular techniques are currently being an essential tool in diagnosing pediatric cancers. Further updates are definitely needed to the current HPE practice and application in pathological diagnosis.

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