Frequency of Solid Pediatric Tumors in Tertiary Care Hospital in Lahore

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Abstract

Objective: To see the frequency of benign and malignant solid pediatric tumors.

Material and Methods: A prospective descriptive study were conducted in Pathology department, University of Child Health Sciences, Children Hospital, Lahore, from January, 2023-December, 23. Histological diagnosis was made on hematoxylin and eosin-stained slides. Immunostaining was also done. Data analysis were done by Statistical Package for the Social Sciences (SPSS) Version 20 and expressed as frequency and percentage.

Results: There were 17 cases of benign tumors of which 10 were females and 7 were males. Mature cystic teratoma was the most common benign tumor. Out of 100 cases of solid malignant tumors 71% were males and 29% were females There were 17 cases of NHL (17%), and all were seen in males with ages from 1-13 years. Whereas, the cases of Hodgkin's disease were 11 (11%). This was also prevalent more in males, the ratio being 9:2. Neuroblastoma was the second most common solid pediatric malignancy (17%) seen in age group1-13 year. Male to female ratio was 12:5. Third most common malignant tumor found was Wilms tumor (13%).

Conclusion: Lymphoma is the most common solid malignant tumor in children followed by neuroblastoma and Wilms tumor. The incidence of malignant tumors is more in males, whereas benign tumors are seen more in females.

Keywords: Hodgkin's lymphoma, non-Hodgkin's lymphoma, Neuroblastoma, Wilms tumor.

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Introduction

Tumors in children are a leading cause of cancer related death. Onset is insidious, often there is delay in diagnosis. Most common childhood malignancies are leukemia, nervous system tumors, non-Hodgkin's lymphoma, Hodgkin's lymphoma and sarcoma.[1,2] Neuroblastomas are 8-10% of all childhood cases of cancer. They can arise in abdomen or thorax.[3] Germ cell tumors may arise in testis, the ovary, mediastinum or brain. They have components of embryonic and extraembryonic endoderm. Histologically, mature teratoma is composed of a mixture of cells derived from all three germ layers. If there is more neural differentiation then it is called malignant teratoma.[4] Wilms tumor is the most common tumor of kidney occurring in children, who often present with hypertension.[5] The prognostic indicators are tumor stage and histological subtype.[6] Histologically, Wilms tumor has blastemal, epithelial and stromal components.[7] In children less than 3 years of age, the tumors usually have embryonal origin. Common brain tumors seen in children are medulloblastoma and gliomas.[8] High grade gliomas are rare and incurable tumors in children.[9] Hepatoblastoma, the most common primary malignant tumor of liver, arises in children especially under 3 years of age. There is increase in serum alpha fetoprotein with this tumor.[10,11]

The most common pediatric ocular malignant tumor

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is retinoblastoma, which has a high cure rate. However, the prognosis is poor in developing countries, where most of the global cases occur (80%).[12] Rhabdomyosarcoma is a high-grade sarcoma, and in children it accounts for 50% of all soft tissue sarcomas.[13]

Material and Methods

It was a prospective descriptive study conducted in the Department of Pathology, University of Child Health Sciences, Children Hospital, Lahore. Study duration was one year (January, 2023-December, 23) . After the taking approval from IRB Committee Ref NO 840/CH-UCHS Dated: 20-05-2024 and after taking patient's consent, data was written on proforma. Speci-men were fixed in formalin, processed and H&E staining was done on all the cases. Histological diagnosis was made on H&E-stained slides. Immunohistochemistry markers WT1, CD 15, CD20, CD 30, CD 45, PAX 5, Desmin, Myogenin, GFAP were also used. Inclusion criteria was pediatric patients (≤ 13 years) of both the sexes having benign and malignant solid tumors. Exclu-sion criteria was patients having metastatic disease and leukemia. Ethical committee approval letter number was 840/CH-UCHS. The data was expressed as frequency and percentage and analyzed using SPSS (Statistical Package for the social sciences) Version 20.0 (SPSS for Windows, SPSS Inc., Chicago, IL, USA).

Results

In our study total number of patients having benign tumors was 17, of which 10 were females and 7 were males. Ages of the patients ranged from 10 days to 13 years. Malignant tumors were found in 100 patients, of which 71 (71%) were males and 29 (29%) were females. The ages of the patients were from 2 months to 13 years. In this study the most common benign tumor was mature teratoma (52.94%) with male to female ratio of 4:5. It was seen in age group 10 days to 12 years. Other benign tumors found were osteochondroma, neurofibroma, pheochromocytoma, hemangioma, ganglioneuroma and pleomorphic adenoma. The incidence of benign tumors was more in females, the male to female ratio being 7:10 (Table 1). Lymphoma was the most common solid malignant tumor in children. There were 17 cases of NHL (17%), of which 2 were of Burkett's lymphoma, and rest of the cases were mostly of high-grade B cell lymphoma. All cases were seen in males with ages from 1-13 years. Whereas, the cases of Hodgkin's disease were 11 (11%). This was also prevalent more in males, the ratio being 9:2 (9 males, 2 females). Neuroblastoma was the second most common solid pediatric malignancy (17%) seen in age group1-13 year. Male to female ratio was 12:5. Third most common malignant tumor found was Wilms tumor (13%), seen in age group 11 months to 12 years (Figure 1 a, b, c, d). Male to female ratio was 7:6. Among the CNS tumors there were 7 cases of glial tumors, of which 2 were pilocytic astrocytoma and the rest were diffuse astrocytoma, WHO grade II. Male to female ratio was 5:2. There were three cases of medulloblastoma, seen in females with ages from 2 months to 13 years. Retinoblastoma (7%) was seen in age group 9 months to 5 years, with a male to female ratio of 6:1. There were 7 cases of Ewing's sarcoma seen in ages from 2-10 years. It was more common in males (5:2). There were 6 cases (6%) of rhabdomyosarcoma. Hepatoblastoma (5%) was found in males of 4 months to 2.5 years. There was one case each of adenoid cystic carcinoma, secretory carcinoma breast, malignant spindle cell carcinoma, rhabdoid tumor and undifferentiated sarcoma (Table 2).

Table 1: *Frequency of benign tumors in children.*

S. no.	Benign tumors	Age range	Males	Females	Total	Percentage
1	Mature teratoma	10 days-12 years	4	5	9	52.94%
2	Osteochondroma	12-13 years	1	1	2	11.76%
3	Neurofibroma	2-6 years	_	2	2	11.76%
4	Pheochromocytoma	13 years	_	1	1	5.88%
5	Hemangioma	9 years	1	_	1	5.88%
6	Ganglioneuroma	7 years	1	_	1	5.88%
7	Pleomorphic adenoma	9 years	_	1	1	5.88%
	Total		7	10	17	100%

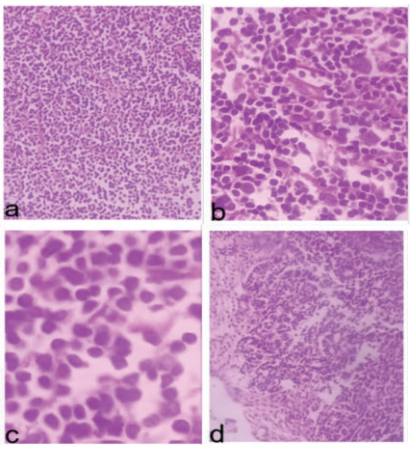

Fig-1: ***a)*** *Photomicrograph of a section of Non-Hodgkin's Lymphoma. b) Hodgkin's Lymphoma. c) Neuroblastoma. d) Wilms tumor (H&E, x400*)

Table 2: *Frequency of malignant solid tumors in children.*

S. no.	Malignant tumor	Age range	Males	Females	Total cases	Percentage
1	Lymphoma					
	Non-Hodgkin's lymphoma	1-13 years	17	_	17	17%
	Hodgkin's lymphoma	3-13 years	9	2	11	11%
2	Neuroblastoma	1-13 years	12	5	17	17%
3	Wilms tumor	11months-12 years	7	6	13	13%
4	CNS tumors					
	Glial tumors (astrocytoma)	6-14 years	5	2	7	7%
	Medulloblastoma	2 months-13 years	_	3	3	3%
5	Retinoblastoma	9 months-5 years	6	1	7	7%
6	Ewing sarcoma	2-10 years	5	2	7	7%
7	Rhabdomyosarcoma	6-8 years	2	4	6	6%
8	Hepatoblastoma	4 months-2.5 years	5	_	5	5%
9	Malignant mixed germ cell tumor	1-6 years	1	1	2	2%
10	Miscellaneous	2-10 years	2	3	5	5%
	Total		71	29	100	100%

Discussion

Malignant tumors in children are rare, but the incidence is increasing and the diagnosis is often delayed. Collecting data regarding cancer incidence can provide information regarding environmental or intrinsic factors.[2,14] Total number of patients having benign tumors was 17, of which 10 were females and 7 were males. Ages of the patients ranged from 10 days to 13 years. Malignant tumors were found in 100 patients, of which 71 (71%) were males and 29 (29%) were females. The ages of the patients were from 2 months to 13 years. In our study the most common benign tumor was mature teratoma (52.94%) with male to female ratio of 4:5. It was seen in age group 10 days to 12 years. Mature cystic teratomas are the most common ovarian masses in children.[15] Other benign tumors found were osteochondroma, neurofibroma, pheochromocytoma, hemangioma, ganglioneuroma and pleomorphic adenoma. Primary benign bone tumors are uncommon and patient can have pain or swelling.16 The incidence of benign tumors was more in females, the male to female ratio being 7:10 (Table-1).

In our study lymphoma was the most common malignant tumor in children. There were 17 cases of NHL (17%), of which 2 were of Burkett's lymphoma, and rest of the cases were of high-grade B cell lymphoma. All cases were seen in males with ages from 1-13 years. The study conducted by Allen CE et al in 2015, also showed that almost all cases of NHL in children are of high grade.[17] Whereas, the cases of Hodgkin's disease were 11 (11%). This was also prevalent more in males, the ratio being 9:2. Study conducted by Britto TI et al (2023) also showed that NHL is more prevalent than Hodgkin's lymphoma.[18] Study conducted by Shah SH et al (2000) also showed that lymphoma is the most common malignant tumor in children and there is higher incidence of lymphoma in males (Fig-1 a, b).[19]

Neuroblastoma was the second most common pediatric malignancy (17%) seen in age group1-13 year. Male to female ratio was 12:5. Study conducted by Hymel E et al (2023) showed that neuroblastoma accounts for 8% of the pediatric cancers.[20] Moreover, it is diagnosed at an early age.[21] Third most common malignant tumor was Wilms tumor (13%), seen in age group 11 months to 12 years (Table 2, Fig-1). Male to female ratio was 7:6. Sharma N et al (2017) concluded that Wilms tumor is the most common renal tumor found in children age 2-11 years, and it is seen more in males.[14] The incidence of abdominal tumors, neuroblastoma, Wilms tumor and hepatoblastoma is highest in children younger than 5 years of age (14%, 10%, 2%). These tumors develop from embryonal and blastemal components (Fig-1 c, d).[22]

There were 7 cases of glial tumors, of which 2 were pilocytic astrocytoma and the rest were astrocytoma WHO grade II. Male to female ratio was 5:2. There were three cases of medulloblastoma, seen in females with ages from 2 months to 13 years. However, the study conducted in Agha Khan Hospital (2000) by Shah S et al shows that CNS tumors (16.6%) are the second most common pediatric neoplasm.19 Study done by Akhlaq M et al (2024) showed meningioma the most common pediatric tumor.[23] Retinoblastoma (7%) was seen in age group 9 months to 5 years, with a male to female ratio of 6:1. Ancona-Lezama D et al concluded that most retinoblastoma cases occur in Asia (53%).12 There were 7 cases of Ewing's sarcoma and the male to female ratio was 5:2. It is the most common sarcoma arising in bones in children and adults.[24] There were 6 cases (6%) of rhabdomyosarcoma. Hepatoblastoma (5%) was found in males of 4 months to 2.5 years. Chen Z et al (2021) found that hepatoblastoma is seen in children under 3 years of age.[10] There was one case each of adenoid cystic carcinoma, secretory carcinoma breast, malignant spindle cell carci-

noma, rhabdoid tumor and undifferentiated sarcoma (Table 2). It is concluded that lymphoma is the most common solid malignant tumor in children followed by neuroblastoma and Wilms tumor. The incidence of malignant tumors is more in males, whereas benign tumors, of which mature teratoma is the most common are seen slightly more in females.

Conclusion

Lymphoma is the most common solid malignant tumor in children followed by neuroblastoma and Wilms tumor. The incidence of malignant tumors is more in males, whereas benign tumors are seen more in females.

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References.

1. Pfister SM, Reyes-Múgica M, Chan JKC, Hasle H, Lazar AJ, Rossi S et al. A Summary of the Inaugural WHO Classification of Pediatric Tumors: Transitioning from the Optical into the Molecular Era. Cancer Discov. 2022 Feb;12(2):331-355. doi: 10.1158/2159-8290.CD-21-1094. Epub 2021 Dec 17. PMID: 34921008; PMCID: PMC9401511.
2. Zhi T, Zhang WL, Zhang Y, Wang YZ, Huang DS. Prevalence, clinical features and prognosis of malignant solid tumors in infants: a 14-year study. Bosn J Basic Med Sci. 2021 Oct 1;21(5):598-606. doi: 10.17305/bjbms.2020.5121. PMID: 33259778; PMCID: PMC8381201
3. Yan P, Qi F, Bian L, Xu Y, Zhou J, Hu J et al. Comparison of Incidence and Outcomes of Neuroblastoma in Children, Adolescents, and Adults in the United States: A Surveillance, Epidemiology, and End Results (SEER) Program Population Study. Med Sci Monit. 2020 Nov 29;26:e927218. doi: 10.12659/MSM.927218. PMID: 33249420; PMCID: PMC7711874.
4. Pierce JL, Frazier AL, Amatruda JF. Pediatric Germ Cell Tumors: A Developmental Perspective. Adv Urol. 2018 Feb 4;2018:9059382. doi: 10.1155/2018/9059382. PMID: 29515628; PMCID: PMC5817207.3249420; PMCID: PMC7711874.
5. Hsiao W, Denburg M, Laskin, B. Hypertension in Wilms tumor. Pediatr Nephrol 2024; 39(1): 15–24. https://doi.org/10.1007/s00467-023-06011-y
6. Groenendijk A, Spreafico F, de Krijger RR, Drost J, Brok J, Perotti D et al. Prognostic Factors for Wilms Tumor Recurrence: A Review of the Literature. Cancers. 2021; 13(13):3142. https://doi.org/10.3390/cancers13133142
7. Bhutani N, Kajal P, Sharma U. Many faces of Wilms Tumor: Recent advances and future direction. Ann Med Surg. 2021; 64: https://doi.org/10.1016/j.amsu.2021.102202
8. Kulubya ES, Kercher MJ, Phillips HW, Antony R, Edwards MSB. Advances in the Treatment of Pediatric Brain Tumors. Children (Basel). 2022 Dec 27;10(1):62. doi: 10.3390/children10010062. PMID: 36670613; PMCID: PMC9856380.
9. Mackay A, Burford A, Carvalho D, Izquierdo E, Fazal-Salom J, Taylor KR, et al. Integrated Molecular Meta-Analysis of 1,000 Pediatric High-Grade and Diffuse Intrinsic Pontine Glioma. Cancer Cell. 2017 Oct 9;32(4):520-537.e5. doi: 10.1016/j.ccell.2017.08.017. Epub 2017 Sep 28. PMID: 28966033; PMCID: PMC5637314.
10. Chen Z, Dong R. Advances in the conventional clinical treatment for hepatoblastoma and therapeutic innovation. World J Pediatr Surg 2021;4:e000220. doi:10.1136/ wjps-2020-000220
11. Czauderna P, Haeberle B, Hiyama E, Rangaswami A, Krailo M, Maibach R et al.: The Children's Hepatic Tumors International Collaboration (CHIC): Novel global rare tumor database yields new prognostic factors in hepatoblastoma and becomes a research model. Eur J Cancer. 2016; 52:92–101. doi: 10.1016/j.ejca.2015.09.023
12. Ancona-Lezama D, Dalvin LA, Shields CL. Modern treatment of retinoblastoma: A 2020 review. Indian J Ophthalmol. 2020 Nov;68(11):2356-2365. doi: 10.4103/ijo.IJO_721_20. PMID: 33120616; PMCID: PMC7774148.
13. Huang C, Jian B, Su Y, Xu N, Yu T, He L, et al. Clinical features and prognosis of paediatric rhabdomyosarcoma with bone marrow metastasis: a single Centre experiences in China. BMC Pediatr. 2021 Oct 21;21(1):463. doi: 10.1186/s12887-021-02904-9. PMID: 34670517; PMCID: PMC8529763.
14. Sharma N, Ahmad A, Bhat GM, Aziz SA, Lone MM, Bhat NA. A profile of pediatric solid tumors: A single institution experience in Kashmir. Indian J Med Paediatr Oncol 2017; 38:471-7. Doi: 10.4103/ijmpo.ijmpo_95_16.PMID: 29333015; PMCID: PMC5759067

15. Gkrozou F, Tsonis O, Vatopoulou A, Galaziou G, Paschopoulos M. Ovarian Teratomas in Children and Adolescents: Our Own Experience and Review of Literature. Children (Basel). 2022 Oct 18;9(10):1571. doi: 10.3390/children9101571. PMID: 36291507; PMCID: PMC9599961.
16. Lam Y. Bone Tumors: Benign Bone Tumors. FP Essent. 2020 Jun; 493:11-21. PMID: 32573182. Available at: https://pubmed.ncbi.nlm.nih.gov-/32573182/
17. Allen CE, Kelly KM, Bollard CM. Pediatric lymphomas and histiocytic disorders of childhood. Pediatr Clin North Am. 2015 Feb;62(1):139-65. doi: 10.1016/j.pcl.2014.09.010. PMID: 25435117; PMCID: PMC4250829.
18. Britto TI, Fattah SA, Rahman MAU, Chowdhury MAU. A Systematic Review on Childhood Non-Hodgkin Lymphoma: An Overlooked Phenomenon in the Health and Research Sector of Bangladesh. Cureus. 2023 Sep 25;15(9):e45937. doi: 10.7759/cureus.45937. PMID: 37900448; PMCID: PMC10601349.
19. Shah, S. H., Pervez, S., Hassan, S. H. (2000). Frequency of malignant solid tumors in children. Journal of Pakistan Medical Association, 50(3), 86-88. Available at: http://ecommons.aku.edu/-pakistan_fhs_mc_pathol_microbiol/292
20. Hymel E, Degarege A, Fritch J, Farazi E, Napit K, Coulter D et al. Agricultural exposures and risk of childhood neuroblastoma: a systematic review and meta-analysis. Environ Sci Pollut Res 30, 113193–113204 (2023). https://doi.org/10.1007-/s11356-023-30315-z
21. Berthold F, Spix C, Kaatsch P, Lampert F. Incidence, Survival, and Treatment of Localized and Metastatic Neuroblastoma in Germany 1979–2015. Pediatr Drugs 2017; 19:577–93 DOI 10.1007/s40272-017-0251-
22. Morin CE, Artunduaga M, Schooler GR, Brennan RC, Khanna G. Imaging for Staging of Pediatric Abdominal Tumors: An Update, From the AJR Special Series on Cancer Staging. American J Roentgenology. 2021; 217(4): available from https://doi.org/10.2214/AJR.20.25310
23. Akhlaq M, Sarfraz S, Ahmed S, Khalid M. The Spectrum of Central Nervous System Tumours at the Tertiary Care Hospital: A Three-Year Study. Esculapio - JSIMS 2022;18(02):200-203. DOI: https://doi.org/10.51273/esc22.251822
24. Iqbal N, Shakir J, Tahir Bokkhari S. Ewing's Sarcoma Chest. Esculapio - JSIMS [Internet]. 2023 Aug. 12 [cited 2024 May 7];9(4):191-3. Available from: https://esculapio.pk/journal/index.php/journal-files/article/view/728

Authors Contribution

BN: Conceptualization of Project
BN: Data Collection
KA: Literature Search
ZR: Statistical Analysis
SZ, ZJ, AJ: Drafting, Revision
KA: Writing of Manuscript