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Solid Malignancies in Children and Adolescents: Experience at the University of Port Harcourt Teaching Hospital

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Summary

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Background and Objective: The prevalence of malignancies in children and adolescents in our locality is largely unknown. The objective of the present study was therefore to determine the hospital incidence and pattern of solid malignancies among children and adolescents aged 16 years and below, who presented at the University of Port Harcourt Teaching Hospital during a 12-year period.

Materials and Methods: All surgical biopsies from patients aged 0-16 years that were diagnosed as malignancies at the Anatomical Pathology department of the University of Port Harcourt Teaching Hospital during the period, January 1, 1990 to December 31, 2001, were retrieved and reviewed. Missing or broken slides were re-cut from tissue blocks and re-stained.

Results: Paediatric and adolescent solid malignancies constituted 8.2 percent of solid malignancies diagnosed during the study period. The commonest of these were Burkitt's lymphoma (41.6 percent), Wilms' tumour (14.5 percent) and rhabdomyosarcoma (12.1 percent). Seventy four percent of the cases which were twice as common in males as in females, occurred before the age of nine years. The head, neck, abdomen, trunk and limbs were the most frequent sites affected. Rhabdomyosarcoma showed a bimodal age distribution. Geographical differences were noted with certain tumours when compared with previous reports from elsewhere in the country.

Conclusion: There is a need for further research on all childhood and adolescent malignancies in our locality including trends and determinants of any geographical variability.

Introduction

OVER the years, it has been reported that the high mortality and morbidity among children in developing countries were largely attributable to preventable diseases such as protein energy malnutrition and infections. However, the role of malignancies as a cause of death in a relatively large number of children in Ibadan has been documented.[1,2] The recognition of the important contribution of malignancies to morbidity and mortality has been linked to improved socio-economic status of the citizens and improved control of some infective conditions which hitherto, had constituted the major causes of childhood morbidity and mortality.[3] Thus, in Nigeria and Africa, high incidences of childhood malignancies are being reported.[3-5] In terms of frequency, previous studies[6] have indicated that the commonest paediatric cancers in the tropics are lymphomas, nephroblastomas, rhabdomyosarcomas and retinoblastomas, while the commonest in the developed countries are leukaemias and intracranial tumours. However, geographical variations in the incidence of cancers have also been reported in Africa[5,7] including Nigeria, as well

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as developed countries.[8] Given the marked disparity in the patterns of childhood leukaemias and lymphomas in the developed and developing world, it is suspected that such differences might be due in part, to environmental factors. Hence, the role of environmental factors in the aetiology of malignancies is increasingly being recognised.[9]

The University of Port-Harcourt Teaching Hospital (UPTH) is a tertiary hospital located in Port-Harcourt, Rivers State; it also receives referrals from four neighbouring states. There are petroleum exploration activities in these areas with the attendant release of toxic metabolites into the environment. In the past, determining the exact incidence of childhood and adolescent cancers had been difficult because of underreporting of cases, inadequate statistics and inadequate diagnostic facilities. The present study is therefore aimed at obtaining baseline data on solid malig-

Table I

Age and Sex Distribution of the Patients

Age Group (Years)	*Male*		*Females*		*Total*	
	No.	*(%)*	*No.*	*(%)*	*No*	*(%)*
0 – 4	43	(24.9)	22	(12.7)	65	(37.6)
5 – 8	40	(23.1)	23	(13.3)	63	(36.4)
9 – 12	16	(9.2)	2	(1.2)	18	(10.4)
13 – 16	18	(10.4)	9	(5.2)	27	(15.6)
Total	117	(67.6)	56	(32.4)	173	(100)

Table II

Site and Frequency Distribution of Solid Malignancies

Type of Cancer	*Head & Neck*	*Lymph Nodes*	*Trunk & Limbs*	*Abdomen*	*Pelvis & Testes*	*Total (%)*
Burkitt's lymphoma	29	25	3	10	5	72(41.6)
Nephroblastoma (Wilms')	-	-	-	25	-	25(14.4)
Rhabdomyosarcoma						
Embryonal	9	-	2	3	-	14(8.1)
Alveolar	2	-	5	-	-	7(4.0)
Retinoblastoma	14	-	-	-	-	14(8.1)
Germ cell tumour						
Yolk sac tumour	-	-	-	-	5	5(2.9)
Immature teratoma	-	-	-	-	3	3(1.7)
Dysgerminoma	-	-	-	-	1	1(0.6)
Granulosa cell tumour	-	-	-	-	1	1(0.6)
Seminoma	-	-	-	-	2	2(1.2)
Neuroblastoma	-	-	-	11	-	11(6.4)
Non-Hodgkin's lymphoma	-	8	-	-	-	8(4.6)
Hepatocellular carcinoma	-	-	-	3	-	3(1.7)
Osteogenic sarcoma	-	-	3	-	-	3(1.7)
Hodgkin's lymphoma	-	2	-	-	-	2(1.2)
Hepatoblastoma	-	-	-	1	-	1(0.6)
Meduloblastoma	1	-	-	-	-	1(0.6)
Total (%)	55(31.8)	35(20.2)	13(7.5)	53(30.6)	17(9.8)	173(100.0)

nant tumours in children and adolescents. It attempts to analyse all the malignant solid tumours diagnosed in children and adolescents aged less than seventeen years at UPTH, with respect to age and sex of patients, sites of occurrence and histological types.

Materials and Methods

All the biopsy (incisional, fine needle aspirate and necropsy) specimens received in the Anatomical Pathology department of UPTH from patients aged 0-16 years which were diagnosed to be malignant from January 1, 1990 to December 31, 2001, were retrieved and re-evaluated. Missing or broken slides were re-cut from the tissue blocks and re-stained with haematoxylin and eosin for the analysis. Special stains, such as the phosphotungstic acid haematoxylin (PTAH), periodic acid schiff (PAS), Masson trichrome and reticulin stains were used in some cases for a more accurate diagnosis and classification. All the cases with inadequate documentation and those whose tissue slides or blocks could not be retrieved were excluded from the study. The results were analysed using simple statistical methods.

Results

A total of 2105 solid malignant tumours were diagnosed during the study period. One hundred and seventy three (8.2 percent) of these were in those aged 0-16 years - an average annual rate of 14.4 cases. Table I shows the frequency distribution of the tumours with respect to age and sex. The male to female ratio was 2:1, while the age distribution reflected an almost equal occurrence among under fives and early childhood (5-8 years). The majority (74 percent) of cases occurred before the age of nine years.

Table II shows the frequency and site distribution of the various malignancies. Burkitt's lymphoma was the commonest solid malignancy accounting for 41.6 percent of all the tumours. This is followed in decreasing order of frequency, by nephroblastoma (Wilms' tumour; 14.5 percent}, rhabdomyosarcoma (12.1 percent), and retinoblastoma (8.1 percent); others included germ cell tumours (6.9 percent), neuroblastoma (6.4 percent), and non-Hodgkin's lymphoma (4.6 percent), among others (Table II). The head, neck, abdomen and the regional lymph nodes were frequently affected with an almost equal relative frequency between the head and neck region (31.8 percent) and the abdomen (30.6 percent). Of all the solid tumours, Burkitt's lymphoma was found at all the sites analysed, with the three commonest sites being the head and neck, lymph nodes and abdomen in decreasing numerical order. Rhabdomyosarcoma was also variably distributed but was found more commonly in the head and neck region.

Table III shows the age distribution of the various solid malignancies. Burkitt's lymphoma which was the commonest tumour, occurred in all age groups with a peak age incidence of 5-8 years, declining gradually in late childhood and adolescence. Nephroblastoma was commoner in the age group, 0-4 years with about half of the cases presenting during this period. Approximately half of the cases presented after four years of age although the distribution showed a gradual decline in the number of cases with increasing age. Juvenile rhabdomyosarcoma showed two peak age incidences, 0-4 and 13-16 years, while retinoblastoma, germ cell

Table III

Age Groups of Children and Adolescents with Solid Malignancies

Malignancies	*Age Groups (yrs)*					
	0 – 4	*5 – 8*	*9 – 12*	*13 – 16*	*Total*	*%*
Burkitt's lymphoma	17	43	8	4	72	(41.6)
Nephroblastoma	13	8	4	-	25	(14.5)
Rhabdomyosarcoma	9	2	2	8	21	(12.1)
Retinoblastoma	8	4	1	1	14	(8.1)
Germ cell cancers	7	3	-	2	12	(6.9)
Neuroblastoma	9	2	-	-	11	(6.4)
Non-Hodgkin's lymphoma	-	1	2	5	8	(4.6)
Hepatocellular carcinoma	-	-	1	2	3	(1.7)
Osteogenic sarcoma	-	-	-	3	3	(1.7)
Hodgkin's lymphoma	-	-	-	2	2	(1.2)
Hepatoblastoma	1	-	-		1	(0.6)
Medulloblastoma	1	-	-		1	(0.6)
Total	65	63	18	27	173	100.0

cancers and neuroblastoma were commoner in the under fives. The analysis showed a trend in which the commoner solid malignant tumours had their peak age incidences in early childhood and within the first decade of life, while the rarer ones such as non-Hodgkin's lymphoma, hepatocellular carcinoma, osteogenic sarcoma and Hodgkin's lymphoma tended to present in the second decade of life.

Discussion

Over the 12-year period, a total of 173 solid paediatric malignancies were documented histopathologically with an average of 14.4 cases annually. This compares with an annual average of 12.0 cases reported from Calabar,[10] but is much lower than the corresponding figures of 100 and 23.7 reported from Ibadan[2] and Ghana,[7] respectively. It is not clear why the figures obtained in this study and that reported from Calabar should be much lower than that of Ibadan. However, since the Ibadan study was conducted about twenty years ago, our figures might represent a real decrease in the incidence of childhood malignancies over the years. A second possibility could be an increased number of referrals to the Ibadan centre during this period. With regard to the annual average figures obtained in the present series and in Calabar, which figures were not too different from that reported from Ghana, geographical similarity might offer some explanation since the studies were conducted within the same decade.

Burkitt's lymphoma constituted 41.6 percent of all solid tumours in this study making it the commonest solid malignant tumour in this centre. This corroborates other Nigerian[2-4,10,11] and African[5,7] studies in which Burkitt's lymphoma has been reported as the commonest childhood malignancy. Although, the relative frequency in the present series is lower than the 50.4, 51.5 and 44.8 percent respectively, reported from three previous studies from Ibadan,[2,12,13] it is much higher than the frequency reported recently from the same centre;[11,14] these have confirmed a decline in the frequency of Burkitt's lymphoma relative to other malignancies. Whereas it is easy to suggest that our values are higher than that recently reported from Ibadan[14] probably because the latter dealt with all malignancies while ours focused only on solid malignancies, it is noteworthy that the previous studies from Ibadan[2,12] that gave higher relative frequencies than ours also included all malignancies but over a long period; these values have consistently declined.[14] However, the disparity in relative frequencies observed between this study (41.6 percent), the previous study from Calabar (23.3 percent)[10] and the latest figure from Ibadan[14] (14.6 percent), all of which were conducted within the same decade, calls for further research on the interplay of regional factors including an increased recognition of the disease, the impact of the control of infections and pollution on the morbidity and mortality from malignancies.

The multiple site involvement by Burkitt's lymphoma is in keeping with its multifocal origin. In our environment, the commonest presentation was in the head/neck region where it presents commonly as a jaw swelling mostly affecting the maxilla. Our study has also identified the deep lymph nodes as the second most frequent site of occurrence of Burkitt's lymphoma in this area. The rank order of the different solid tumours places Wilms' tumour in the second place with a frequency of 14.5 percent. Although this figure differs from the value of 5.6 percent from Williams' study,[2] it corroborates the values of 14.4 percent and 13.2 percent reported from Ibadan[13] and Jos,[4] respectively. The disparity between the lower frequency of 5.6 percent in Williams' study[2] and the 14.4 percent of Johnson and Williams[13] (both studies from Ibadan), may be due to the fact that the former studied childhood tumours from all sites, whereas the latter dealt with abdominal tumours only. Comparatively, our study like the Jos study, dealt only with solid childhood and adolescence tumours yielding similar frequencies for Wilms' tumour. Comparing our study with the latest study from Ibadan,[14] the frequency of rhabdomyosarcoma was similar, retinoblastoma lower, while that of neuroblastoma was higher in the present series. The second position of Wilms' tumour in this study is also at variance with the recent Ibadan study[14] that had retinoblastoma as the second (17.9 percent) commonest childhood malignancy. Although Ojesina, *et al*[14] have documented that the relative frequency of Wilms' tumour had not changed significantly in the last four decades, that there has been an increased incidence of retinoblastoma and an abrupt decline in that of neuroblastoma, it is difficult to compare this trend with our data, without an appropriate time trend study.

Another striking difference between our study and previous reports from Ibadan is the rarity of central nervous system tumours which had consistently ranked third in Ibadan.[14] A possible explanation could be that during the period covered by this study, there was no functional Computerised Axial Tomography (CT) machine or Magnetic Resonance Imaging (MRI) facilities. Most suspected cases of intracranial tumours were therefore, referred to centres such as the University College Hospital, Ibadan, after which such patients were usually lost to our follow-up.

The peak age incidence of Burkitt's lymphoma was similar to that reported in previous studies[1,6,10] with 60-70 percent of our patients presenting between 5-12 years. Fifty two percent of our Wilms' tumour cases presented within the first four years of life. This is also

similar to the peak age incidence of Wilms' tumour from Ibadan where 52 percent presented in the first three years of life.[12] However, it is known that Wilms' tumour is an embryonic tumour. Therefore, for as many as 48 percent of our cases to have presented between 5-12 years suggests a significant degree of occurrence of the tumour at older ages as opposed to neuroblastoma in which 90 percent of our patients presented within the first four years of life. The diagnosis of Wilms' tumour at older ages may well explain the low survival rates of some cases of the disease that have been recorded in previous studies,[15,16] since this would suggest that being an embryonic tumour, such tumours might already be in an advanced stage at the time of presentation; this needs to be explored further.

Rhabdomyosarcoma, which is the commonest soft tissue sarcoma[17] in childhood, contributed 12.1 percent of the cases in this study. It showed a bimodal age incidence which has also been reported in previous studies.[17,18] It is one of the few tumours showing small round blue cells in children less than 16 years of age.[19] The bimodal age incidence suggests a trigger factor to malignant proliferation in early childhood which appears to subside in the school age period and becomes operational again in adolescence. Besides, the site of involvement and the histology of the tumour have been shown to be interrelated. For instance, whereas the young child typically has head and neck or pelvic tumour of embryonal or butryoid histology, the adolescent typically has limb tumours of alveolar histology with a worse prognosis than that of the younger child.[20] In this study, 52.4 percent of the cases presented with the embryonic type in the head and neck region while 47.6 percent presented with alveolar tumours of the trunk, limb and abdominal lesions which usually have poorer prognosis. Retinoblastoma has been described as a genetically determined tumour. It is the commonest orbital tumour in Nigeria occurring uni- or bi-laterally. In this series, it presented mostly in patients less than five years of age. This observation had been made previously[5] even though higher ages have been reported from Calabar.[10]

The variations in frequencies of solid paediatric tumours in the present study compared to previous ones call for further research in the area with a view to identifying factors that may influence relative frequencies and geographical variability.

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