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ORIGINAL ARTICLE

Histopathological Review of Childhood and Adolescent Cancers in Northern Ghana

Examen Histopathologique des Cancers de L'enfant et de l'Adolescent dans le Nord du Ghana

[1,2]*E. M. Der, [3,4]F. A. Abantanga

ABSTRACT

BACKGROUND: Published data on childhood and adolescent cancers in northern Ghana is scanty. The aim of this retrospective histopathological study was to identify and describe the relative proportions of childhood and adolescent cancers and the associated clinico-pathological features at the Tamale Teaching Hospital.

MATERIALS AND METHODS: The cancers were classified according to the International Classification for Cancer in Children. Data was collected on the demographics and the clinico-pathological characteristics of the various types of cancers, from 1 st January 2012 to 31st December, 2021, a 10-year period. The data was analysed using SPSS software (Version 26, Chicago).

RESULTS: A total of 196 childhood and adolescent cancers were reviewed, with a mean age of 9.5± 5.5 years. Approximately, 51.5% were female, with a younger mean age (years) of 8.4±5.3, compared to 10.6±5.6 for males. Majority (74.0%), were within the 0–14 years age group, (P<0.0001). All the patients presented with swellings and mostly after 6 months of disease onset. The common cancers for the study population were: soft tissue sarcoma (24.2%), primary bone cancer (21.1%), retinoblastoma (17.5%), lymphoma (13.3%), and germ cell tumours (6.7%). For females these were: soft tissue sarcoma (21.0%), retinoblastoma (20.0%), primary bone cancer (19.0%), nephroblastoma (13.0%), and ovarian tumours (12.0%). For males, these were: soft tissue sarcoma (27.7%), bone cancer (23.4%), lymphoma (19.1%), retinoblastoma (14.9%) and head and neck cancer (6.4%). The common soft tissue cancers were: rhabdomyosarcoma (46.8%), and spindle cell sarcoma (NOS) (17.0%). Osteosarcoma (70.7%), and Ewing's sarcoma 6 (14.6%) were the common primary bone cancers. Many (46.4%) of the retinoblastomas were of a high pathological TNM stage III. The optic nerve was involved in 70.6%, with 26.5% margin involvements.

CONCLUSION: Childhood and adolescent cancers were common in pediatric age group with late stage at presentation. The common histological subtypes were: soft tissue sarcoma, primary bone cancer and retinoblastoma. There is the need for detection, diagnosis, and prompt oncology care. **WAJM 2022; 39(12): 1229–1237.**

Keywords: Childhood, Adolescent, Cancer, Northern Ghana.

RÉSUMÉ

CONTEXTE: Les données publiées sur les cancers de l'enfant et de l'adolescent dans le nord du Ghana sont rares. Le but de cette étude histopathologique rétrospective était d'identifier et de décrire les proportions relatives des cancers de l'enfant et de l'adolescent et les caractéristiques clinico-pathologiques associées à l'hôpital universitaire de Tamale.

MATÉRIEL ET MÉTHODES: Les cancers ont été classés selon la Classification internationale du cancer chez l'enfant. Des données ont été recueillies sur les caractéristiques démographiques et clinico-pathologiques des différents types de cancers. Les données ont été analysées à l'aide du logiciel SPSS (version 26, Chicago).

RÉSULTATS: Un total de 196 cancers d'enfants et d'adolescents ont été examinés, avec un âge moyen de 9,5± 5,5 ans. Environ 51,5 % étaient des femmes, avec un âge moyen plus jeune (ans) de 8,4±5,3, contre 10,6±5,6 pour les hommes. La majorité des patients (74,0 %) étaient âgés de 0 à 14 ans (P<0,0001). Tous les patients présentaient des gonflements, le plus souvent après 6 mois d'apparition de la maladie. Les cancers les plus fréquents dans la population étudiée étaient les suivants : sarcome des tissus mous (24,2%), cancer osseux primaire (21,1%), rétinoblastome (17,5%), lymphome (13,3%) et tumeurs germinales (6,7%). Pour les femmes, il s'agissait de sarcomes des tissus mous (21,0 %), de rétinoblastomes (20,0 %), de cancers osseux primaires (19,0 %), de néphroblastomes (13,0 %) et de tumeurs ovariennes (12,0 %). Chez les hommes, il s'agissait de : sarcome des tissus mous (27,7%), cancer des os (23,4%), lymphome (19,1%), rétinoblastome (14,9%) et cancer de la tête et du cou (6,4%). Les cancers des tissus mous les plus fréquents étaient : le rhabdomyosarcome (46,8%) et le sarcome à cellules fusiformes (NOS) (17,0%). Les cancers osseux primaires les plus fréquents étaient l'ostéosarcome (70,7 %) et le sarcome d'Ewing (14,6 %). Un grand nombre (46,4 %) des rétinoblastomes étaient d'un stade pathologique élevé (TNM III). Le nerf optique était impliqué dans 70,6 % des cas, avec 26,5 % d'implication des marges.

CONCLUSION: Les cancers de l'enfant et de l'adolescent étaient fréquents dans le groupe d'âge pédiatrique avec un stade tardif à la présentation. Les sous-types histologiques les plus fréquents étaient : le sarcome des tissus mous, le cancer primaire des os et le rétinoblastome. Il est nécessaire de détecter, de diagnostiquer et de fournir des soins oncologiques rapides. **WAJM 2022; 39(12): 1229–1237.**

Mots clés: Enfance, Adolescence, Cancer, Ghana du Nord.

[1]Department of Pathology, School of Medicine, University for Development Studies; PO Box TL Tamale. [2]Department of Pathology, Tamale Teaching Hospital, Tamale. [3]Department of Surgery, School of Medicine , University for Development Studies, Tamale. [4]Department of Surgery, Tamale Teaching Hospital, Tamale.

***Correspondence:* Prof. Edmund Muonir Der,** Department of Pathology, School of Medicine, University, Development Studies, Tamale. E-mails: edmunder1869@gmail.com maadelle@yahoo.com. Tel:+233208709807/248416288.

INTRODUCTION

Childhood and adolescent cancers are fast becoming an important public health problem globally, more so in parts of Africa, where there is a progressive decline in infectious and nutritional related morbidities and mortalities.[1–5] Cancer contributes significantly to the high morbidity and mortality rates in these age groups in both the developed and developing countries.[1,3,4] These cancers are fundamentally different from the adult forms in terms of the tumour type, aetiology, biology, management protocols, the therapeutic responses and prognostic outcomes.[2–5]

The spectrum, relative proportions presented histological subtypes of childhood and adolescent cancers and prognosis of such cancers vary across the globe, reflecting the environmental, genetics, immune status, and the availability of modern health infra-structures with the requisite specialists; pediatric surgeons, oncologist, haematologist and pathologist, in a given country.[3–5] Many researchers have reported higher proportions of these cancers in the age group 0–14 years, and more in males than females.[2]

The epidemiology of various cancers has been studied in children and older adult populations for nearly half a century.[6–8] Remarkably little attention has been given to the cancers in the adolescent age group.[6] Previous studies regarding pediatric cancers in Ghana were all within the middle and southern belts of the country and importantly, the study populations were limited to the age group 0–14 years.[9] The question are: what is the pattern of pediatric and adolescent cancers in northern Ghana, the geographical area commonly described as a poverty endemic region of Ghana? What are the clinicopathological features of these cancers? And what are the histological subtypes? The aim of this retrospective histopathological study was to identify and describe the relative proportions of childhood and adolescent cancers and the associated clinico-pathological features, at the Tamale Teaching Hospital from 1st January, 2012 to 31st December, 2021, and offer recommendations for further research in this area.

MATERIALS AND METHODS

Study Design

This was a descriptive retrospective histopathological review conducted from 1st January 2012 to 31st December, 2021, a 10-year period.

Study Site

The study was conducted in the Department of Pathology, Tamale Teaching Hospital (TTH). This is the largest referral hospital serving all the regions in northern Ghana and beyond, particularly, neighbouring Burkina Faso, as reported in previous studies.

Case Selection

1. All neoplastic lesions diagnosed in persons within the age group of 0 – 18 years
2. All histologically confirmed childhood and adolescent cancers in the Department of Pathology, Tamale Teaching Hospital.

Exclusion Criteria

1. All poorly fixed specimens and those with incomplete records were excluded.
2. All benign childhood and adolescent tumours were excluded.

Data Collection, Entry and Analysis

Six hundred and seventy (670) histopathology request forms of patents aged between 0 and 18 years together with specimens were submitted to the Department of Pathology by clinicians with clinical impression of neoplastic lesion for the period 1st January, 2012 to 31st December, 2021. The corresponding completed histopathology reports of all these cases were also retrieved. A total of 196 (29.3%) of the samples were histopathologically confirmed as malignant; this constituted the sample size used for the study.

Data were collected on the age (years) at presentation; grouped into childhood (0–14) and adolescent (15–18 years). The age (years) at diagnosis was further stratified into 0–4, 5–9, 10–14 and 15–18, respectively.

The relevant clinical history (symptoms, duration, laterality, type of operation) and type of surgical specimens were collected. We also collected data on the histopathological subtypes of cancer, the grade, lymph node involvement, and the TNM stage of nephroblastomas, retinoblastomas, and germ-cell tumours as well as the status of the resection margins. For retinoblastoma, the following parametres; gross dimension of the tumour, necrosis, haemorrhage, optic nerve invasion, and the length of invasion, choroid invasion and the involvement of the resection margin, were added when present in the sample.

The TNM staging (pathological) for cancer in this study was the system recommended by the American Joint Committee on Cancer (AJCC), (AJCC 6th edition of the cancer staging manual, 2002, New York) which takes into account the size of the primary tumour (T), measured macroscopically and in some instances microscopically by the pathologist, presence and extent of regional lymph node involvement (N), and whether or not the cancer has spread to other areas of the body (metastasis, (M). Childhood and adolescent cancers in this study were classified according to the third revision of the International Classification of Childhood Cancer (ICCC-3).

RESULTS

Age and Sex Characteristics of the Study Population

A total of 196 childhood and adolescent cancers were reviewed from 1st January 2012, to 31st December 2021. Their ages (years) ranged from 0.5–18.0, with a mean of 9.5± 5.5. Majority, 145 (74.0%), were within the childhood age group (0–14 years), compared to 51 (26.0%) who were adolescents (15–18 years), ($P<0.0001$). There were 101 (51.5%) females and 95 (48.5%) males. Females were relatively younger (mean age of 8.4±5.3 years), compared to their male counterparts (mean age of 10.6±5.6 years) (Table 1).

Histological Subtypes of Childhood and Adolescent Cancers in Northern Ghana

1. ***Whole Study Population***

   The common histological subtypes of childhood and adolescent cancers were: soft tissue sarcoma (24.2%), bone cancer (21.1%), retinoblastoma (17.5%), lymphoma

(13.3%) and nephroblastoma (8.8%) (Table 2).

2. ***Female Patients***
The common histological subtypes of childhood and adolescent cancers in females were: soft tissue sarcoma (21.0%), retinoblastoma (20.0%), and bone cancer (19.0%) (Table 2).

3. ***Male Patients***
The common histological subtypes of childhood and adolescent cancers in males were: soft tissue sarcoma (27.4%), bone cancer (23.2%) and lymphoma (18.9%) (Table 2).

Soft Tissue Sarcoma (n = 47)

Soft tissue sarcomas were common (14, 29.8%) among patients aged 10–14 years, with a little above half (55.3%) being males (Table 3). The common clinical presentations were painless swelling 42 (89.4%), fungating ulcers 3 (6.3%), and acute retention of urine 2 (4.3%). Of those with stated duration at presentation, 51.3% presented to a health facility after 6 months of illness (Table 3).

The common histological subtypes of soft tissue cancers were: rhabdomyosarcoma 22 (46.8%), spindle cell sarcoma (not otherwise specified, [NOS]) 8 (17.0%), fibrosarcoma 5 (10.6%), dermatofibrosarcoma protuberans 3 (6.4%) and liposarcoma 2 (4.35) (Table 4).

Primary Bone Cancers (n = 41)

Primary bone cancers were slightly common (55.0%) in the childhood period, and in males (53.7%) (Tables 3 and 5). The common presentation was a painless swelling 27 (65.9%) (Table 5). A total of 36 (87.8%) cases had stated duration at presentation, and 23 (63.9%) reported to a health facility after 6 months of illness (Tables 3 and 5). The common bones of involvement were: the distal end of the femur and the proximal ends of the femur and tibia (knee joint) 12 (30.0%), femur 9 (22.5%), tibia 7 (17.5) and the phalanges of the hand 4 (10.0%) (Table 5).

The common histological subtypes of bone cancers were: Osteosarcoma 29 (70.7%), and Ewing's sarcoma 6 (14.6%) (Table 5).

Lymphoma (n = 26)

Lymphomas were commoner 23 (88.5%) in the pediatric age group, particularly those within 5–9 years 13 (50.0%) (Table 3). Many, 18 (69.2%), were males (Table 3). The great majority 23 (88.5%) presented with painless lymph node swellings, with 3 (11.5%) presenting

Table 1: Age Distribution of Childhood and Adolescent Cancers

Age Group (years)	Whole Group		Female		Male	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
0 – 4	55	28.1	34	33.7	21	22.1
5 – 9	40	20.4	22	21.8	18	18.9
10 – 14	51	26.0	25	24.7	26	27.4
15 – 18	50	25.5	20	19.8	30	31.6
Total	**196**	**100.0**	**101**	**100.0**	**95**	**100.0**
Sub-groups(years)						
0 – 14	145	74.0	81	80.2	65	68.4
15 – 18	51	26.0	20	19.8	30	31.6
Total	**196**	**100.0**	**101**	**100.0**	**95**	**100.0**

Table 2: Histological Subtypes of Childhood and Adolescent Cancers

Histological Diagnosis	Whole Group		Female		Male	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Retinoblastoma	34	17.3	14	14.7	20	19.8
Primary bone cancers	41	21.0	22	23.2	19	18.8
Soft tissue cancers	47	24.0	26	27.4	21	20.8
Renal cancers	17	8.7	4	4.2	13	12.9
Lymphomas	26	13.2	18	18.9	8	7.9
Germ cell tumours	13	6.7	1	1.1	12	11.9
Head and neck cancers	11	5.6	6	6.3	5	5.0
Neuroblastoma	3	1.5	2	2.1	1	1.0
Skin cancers	3	1.5	2	2.1	1	1.0
Astrocytoma	1	0.5	0	0.0	1	1.0
Total	**196**	**100.0**	**95**	**100.0**	**101**	**100.0**

Table 3: Age, Gender and Duration at Presentation of the Histological Subtypes of Childhood and Adolescent Cancers

	Soft Tissue Cancer N (%)	Bone Cancer N (%)	Retino- Blatoma N (%)	Lymphoma N (%)	Renal Cancer N (%)	Germ Cell Tumour N (%)	Head/Neck Cancer N (%)
Age(years)							
0 – 4	12(25.5)	3(7.3)	25(73.5)	3(11.5)	7(41.2)	2(15.3)	1(9.1)
5 – 9	9(19.1)	4(9.8)	8(23.5)	13(50.0)	4(23.5)	1(7.7)	1(9.1)
10 – 14	14(29.8)	15(39.0)	1(2.9)	7(26.9)	3(17.6)	5(38.5)	3(27.3)
15 – 18	12(25.5)	18(43.9)	0(0.0)	3(11.5)	3(17.6)	5(38.5)	6(54.5)
Total	**47(100.0)**	**40(100)**	**34(100)**	**26(100.0)**	**17(100.0)**	**13(100.0)**	**11(100.0)**
Mean age (years)	9.9 ± 5.5	13.1 ± 3.8	3.3 ± 1.7	8.1 ± 4.4	7.6 ± 5.6	11.5 ± 5.0	13.2 ± 4.7
Gender							
Female	21(44.7)	19(34.1)	20(58.8)	8(30.8)	13(76.5)	12(92.3)	5(45.5)
Male	26(55.3)	22(53.7)	14(41.2)	18(69.2)	4(23.5)	1(7.7)	6(54.5)
Duration (Months)							
0 – 6	19(48.7)	13(36.1)	11(36.7)	23(88.5)	8(61.5)	5(38.5)	2(18.2)
>6	20(51.3)	23(63.9)	19(63.3)	3(11.5)	5(30.8)	8(61.5)	9(81.8)

Table 4: Histological Subtypes of Soft Tissue Sarcomas

Type of Soft Tissue Malignancy	Frequency (n)	Percentage (%)
Rhabdomyosarcoma	22	46.8
Spindle cell sarcoma (NOS)	8	17.0
Fibrosarcoma	5	10.6
Dermatofibrosarcoma protuberans	3	6.4
Liposarcoma	2	4.3
Monophasic synovial sarcoma	2	4.3
Epithelioid sarcoma	2	4.3
Angiosarcoma	1	2.1
Infantile haemagiopericytoma	1	2.1
Malignant fibrous histiocytoma	1	2.1
Total	**47**	**100.0**

with intra-abdominal masses. Majority, 23 (88.5%), presented at the health facility within 1 – 6 months of onset of the illness (Table 3). The commonest site of involvement was the neck region (17, 65.4%) (Table 7). The common subtypes of lymphoma were: Burkitt's 14 (53.9%), and diffuse large cell Non-Hodgkins 6 (23.15) (Table 7).

Renal Tumour (n = 17)

Renal cancers were commonly diagnosed in the age group 0–14 years (14, 82.4%) (Table 3). All the patients presented with intra-abdominal masses. The sites of involvements were: left kidney 9 (52.9%), right kidney 6 (35.3%) and bilateral 2 (11.8%). Many (61.5%) patients with renal tumours presented within 6 months of onset of illness (Table 3). The histological subtypes of renal cancers were nephroblastoma (Wilms tumour) (81.3%) and renal cell carcinoma (18.75), (P<0.0001).

Retinoblastoma (N= 34)

Retinoblastoma commonly (91.2%) presented as a white patch on the eye in affected patients. Approximately, 63.3% of those with stated duration of illness presented after 6 months of onset of illness (Table 3). The right eye was commonly (47.1%) involved, followed by the left eye (38.2%), and bilateral (14.7%) involvement. Majority (88.2%) of the samples were enucleations, followed by incision biopsies (11.8%). A total of 28 cases had pathological TNM staging, of which 13 (46.4%) were stage 3 (Table 6). The optic nerve was involved in 70.6% of the cases (P = 0.0014). The great majority 29 (85.3%) involved the whole retina (P<0.0001) (Table 6).

DISCUSSION

Our study provides insight into the demographic and clinical features, histopathological subtypes (spectrum), and the relative proportions of childhood and adolescent cancers in northern Ghana. The mean age at diagnosis with childhood and adolescent cancer in this current study conducted in the largest referral hospital in northern Ghana was 9.5±5.5 years, females were relatively younger (mean age of 8.4±5.3 years) than their male counterparts (mean age of 10.6±5.6 years). Again, majority (74.0%) of the study population were within the pediatric age group: 0–14 years (P<0.0001). The age characteristics in this current study is similar to that reported in previous studies globally.[2,6,7] For instance, Binesh *et al.,* in their study of childhood and adolescent cancers in Iran, reported a mean age of 9.88±5.7 years.[6] We found a slight female predominance compared to the male (51.5% vs 48.5% respectively). The slight female predominance in this institution based study differs from other studies in Africa and other parts of the world[2,8] that found pediatric and adolescent cancers to be common among male patients. There are no obvious reasons for the differences, but this may be attributable to the fact that, the northern Ghana study was a

Table 5: The Clinico-pathological Features of Primary Bone Cancers in Childhood and Adolescent Patients

	Osteosarcoma	Ewing's Sarcoma	Chondrosarcoma	Plasmacytoma	Total (n/%)
Age (years)					
0 - 14	18	2	2	0	22(55.0)
15 - 18	11	3	3	1	18(45.0)
Total*	29	5	5	1	40 (100.0)
Gender					
Male	15	6	0	1	22(53.7)
Female	14	0	5	0	19(46.3)
Symptoms					
Painless swelling	21	4	1	1	27(65.9)
Painful swelling	8	2	4	0	14(34.1)
Duration (months)					
≤6	9	3	2	0	14(38.9)
≥7 – 12	15	2	4	1	22(61.1)
Total**	24	5	6	1	36(100.0)
Location					
Knee joint	12	0	2	0	14 (34.1)
Femur	5	3	1	0	9(22.0)
Tibia	5	0	2	0	7 (17.1)
Hand	2	2	0	0	4 (9.8)
Humerus	1	0	0	1	2(4.9)
Mandible	2	0	0	0	2 (4.9)
Rib	1	0	0	0	1(2.4)
Shoulder	1	0	0	0	1(2.4)
Ulnar	1	0	0	0	1(2.4)

**, Missing data on age (1), **, Missing data on duration (7)*

single institution based review over a period of ten years with a relatively small sample size. For instance, Stefan et al[2]., study, had a sample size of 10,545, being a pooled results from 16 population-based registries in sub-Saharan Africa.

The first five common histological subtypes of childhood and adolescent cancers were: soft tissue sarcoma (24.2%), primary bone cancer (21.1%), retinoblastoma (17.5%), lymphoma (13.3%) and nephroblastoma (8.8%). The pattern of pediatric and adolescent cancers in this current study points to a complete departure from that reported in previous studies in Africa.[1,2,4,5,8,9] For instance, Hadley, *et al.,*[4] reported the pattern in northern Africa as: leukemia, brain tumours, nephroblastoma and neuroblastoma, while Stefan *et al.,*[2] found the order to be: lymphoma, nephroblastoma, non-Hodgkin's lymphoma, and rhabdomyosarcoma. Furthermore, Obioha *et al.,*[5] in Nigeria, Teka *et al.,*[8] in Ethiopia, and Welbeck *et al.,*[9] in Ghana, all reported lymphoma as the commonest malignant pediatric cancer in their various studies, contrary to our findings. Again, studies conducted outside Africa reported patterns equally different from our study in northern Ghana.[6,7,10,11] Binesh *et al.,* in Iran, found the pattern to be: leukemia (37.8%), lymphoma (22.1%), central nervous system tumours (8.6%), soft tissue sarcoma (8.6%) and germ cell tumours (3.2%).[6] A study by Ghasemi *et al.,* in Sari (Mazandaran), reported the pattern to be: leukemia (30.5%), lymphoma (16.4%), melanoma (14.5%), and soft tissue sarcoma (9.5%).[7] Again, Punia *et al.,*[11] study in Indian found the following pattern: central nervous system tumours, malignant bone tumours, and soft tissue sarcomas. The reasons for the complete departure of our findings with previous published cancer data in these age groups are unknown currently, partly because this is the first study in this part of Ghana and the small sample size. However, this pattern may be attributed to the lack of awareness of the disease (cancer) among the populace, environmental and geographical differences, and more importantly, the availability of healthcare infrastructure and specialists, to diagnose and request for histopathological examination and confirmation of suspected lesions. For instance, Binesh *et al.,* in Iran,[6] Ghasemi *et al.,* in Sari[7] and Punia *et al.,* in India,[11] all found central nervous tumours as being among the first five common childhood and adolescent cancers in their various studies. We had just a single case of astrocytoma and not a single case of leukemia. The rarity of brain tumour as well as leukemia in this study may be due to the fact that Leukemias are not diagnosed in the histopathology laboratory and thus records from the Department of Pathology will not contain such cases. Again, TTH has a limited number of specialists in some disciplines who will diagnose and manage these cases. For instance, there is only single a neurosurgeon in hospital, but no haematologist. Previous researchers have argued that the lack of specialists and diagnostic facilities in low-income settings make it very difficult to diagnose some of the more common pediatric malignancies, particularly leukemia and brain tumours, thus making these cancers rare in the developing countries[12,13] as in this current study in northern Ghana. This calls for a serious re-look at the health infrastructure in northern Ghana, posting of specialists and initiation of residency training in northern Ghana. Also, there is the need to intensify health education on early detection, reporting and diagnosis of childhood and adolescent cancers. Here the focus may be directed at parents, health care providers and non-Governmental agencies involved in health policy development and other activities.

Soft Tissue Sarcoma

Soft tissue sarcoma was identified in this current study to be the leading cancer, more so in the pediatric age group. This is in line with some previous studies that reported sarcomas to be common among the pediatric population.[14,15] This group of cancers was found to be slightly common in males. This agrees with Kachanov *et al.,* in Moscow, Russia, who found soft tissue sarcomas to be male predominant in their

Table 6: Histopathological Features of Retinoblastoma

	Frequency (n)	Percentage (%)	P-Values
Pathological (pTNM) Staging (n= 28)			
Stage 1	8	28.6	
Stage 2	6	21.4	
Stage 3	13	46.4	
Stage 4	1	3.6	
Optic Nerve Involvement (n = 34)			0.0014
Yes	24	70.6	
No	10	29.4	
Length of Optic Nerve Involvement (mm) (n = 22)			0.7635
≤0.5	12	54.5	
>0.5	10	45.5	
Total	22	100.0	
Involvement Optic Nerve Margin (n = 34)			0.0002
Yes	9	26.5	
No	25	73.5	
The whole Retina Involvement by Retinoblastoma (n = 34)			0.0001
Yes	29	85.3	
No	5	14.7	

Table 7: The Clinico-pathological Characteristics of Childhood and Adolescent Lymphomas

Variable	Frequency (n)	Percentage (%)
Clinical Symptom		
Swellings	26	100.0
Anatomic Site		
Neck	17	65.4
Ovary	3	11.5
Inguinal region	2	7.7
Axilla	1	3.8
Kidney	1	3.8
Spleen	1	3.8
Mesentery	1	3.8
Total	26	100.0
Histological Subtypes		
Burkitt's lymphoma	14	53.9
Diffuse large cell lymphoma	6	23.1
Hodgkin's lymphoma	5	19.2
Angio-immunoblastic lymphadenopathy	1	3.8
Total	**26**	**100.0**

study on childhood and adolescent cancers.[16] Our patients with soft tissue sarcomas commonly presented late with huge and advanced disease similar to previous findings.[16] The common histological subtypes of soft tissue cancer were: rhabdomyosarcoma (46.8%), spindle cell sarcoma (NOS) (17.0%), fibrosarcoma (10.6%), dermatofibrosarcoma protuberans (6.4%) and liposarcoma (4.3%). The pre-dominance of rhabdomyosarcoma as a childhood and adolescent cancer in this current study, supports many previous studies regarding cancers in this age group.[16–19] For instance, rhabdomyosarcoma accounted for about 46.8% of the soft tissue cancers in the current study, very close to the 50.0% reported in the study by Brecht *et al.*[19]

Primary Bone Cancers

Literature on primary bone tumours in Africa is scarce due to the low priority and attention given to surgical oncology in the continent and the absence of cancer registries in most countries in Africa.[4] Similarly, an expanded spectrum of primary bone malignancies in Ghana has not been well documented, except case reports.[20] In this study, primary bone cancers were found to be common (55.5%) among patients aged 0–14 years, and slightly higher in males (53.7%). The age and gender characteristics of primary bone cancers reported by the current study in northern Ghana, are in accordance with those of previous studies in Africa and beyond.[4,20–23] For instance, Ghert *et al.,*[23] in Tanzania, found these cancers to be of male predominance with a male: female ratio of 1.4:1.

Most bony malignancies start as painless swellings and patients may give no or little attention to the condition. In most cases, native treatment is started and the patient only reports to a health facility for management when the disease is advanced with the primary clinical features completely masked. Again, the similarities in the clinical presentation of benign and malignant bone tumours in many situations result in delay in accurate diagnosis and prompt treatment by clinicians.[20] We found the commonest presentation of bone cancer to be a painless swelling (65.9%), similar to the presentation in previous studies.[20,23] Many (63.9%) of the patients presented late (after 6 months) with advance stage of the disease. Late and advanced stage at presentation with primary bone cancers in Africa has been documented.[20,23–25] This pattern has been attributed to the behavioural, cultural practices and the low socioeconomic status of people in many countries in Africa.[24,25]

The current study found the commonest site of bone malignancy to be the knee joint (30.0%) followed by the proximal two-thirds of the femur bone (22.5%) and the lower two-thirds of the tibia bone (17.5%). The anatomic sites of involvement are in keeping with previous studies.[20,23]

The common histological subtypes of bone cancers were: osteosarcoma (70.7%), Ewing's sarcoma (14.6%),

chondrosarcoma (12.3%), and plasmacytoma (2.4%). The current findings support studies across the globe that reported osteosarcoma as the commonest malignant bone tumour in children and adolescents.[14,23,26] For instance, Kaatsch *et al.,*[26] in Germany, reported osteosarcomas and Ewing tumours as the most frequently diagnosed primary bone cancers in their study.

Retinoblastoma

The current study found retinoblastoma to be the third common childhood and adolescent cancer in northern Ghana. It was found to be commoner in the paediatric age group, particularly within the 0–4 years (73.5%); there were no cases in adolescents. Retinoblastoma was also found to be common in females. The relative frequency and demographic features of retinoblastoma in this current study confirmed reports that, the disease is the most common malignant intraocular tumour in children globally, especially in the 0–4 age group.[9,27–30] This is further supported by available data on paediatric malignancies in Ghana that found it to be common among Ghanaian children [9,31–33] For instance, Painstil *et al.,*[32] in their study in the Ashanti Region of Ghana reported retinoblastomas as a common pediatric cancer. Similarly, Der *et al.,* in their study on primary orbito-ocular malignant tumours in northern Ghana found retinoblastoma as the commonest tumour in the pediatric age group.[33] However, the female predominance in this current study differs from previous studies that reported the disease to be common among males.[32,34,35]

Patients diagnosed with retinoblastoma in this study presented late with advanced disease and visual loss. For instance, 63.3% of the children presented to health facilities for management of their conditions after 6 months of onset of the disease condition. This clinical picture is similar to previous studies decades ago in southern Ghana,[36–38] and other parts of the globe.[35,39] Late presentation of retinoblastoma in Ghana and other parts of Africa has been attributed to the fact that the symptoms of retinoblastoma are not evident early in the disease; besides patients and/or their relatives may resort to several treatment options such as herbal and/or self-medication, and will only present to a health facility when the disease is clinically advanced; proptosis with vision loss is what brings them to hospital for the first time in developing countries,[36–39] as seen in this current study from northern Ghana.

Further evidence in support of the advanced clinical state at presentation of retinoblastomas in this current study is the fact that, 88.2% of the cases were diagnosed in enucleated samples, showing that the eyes of such patients were beyond salvage. The choice of extensive surgery as a management option for advanced orbito-ocular disease may not be peculiar to this current study. For instance, Aghogho *et al.,*[40] in Nigeria similarly reported enucleation as a common surgical method for managing advance orbito-ocular tumours.

Histopathological examination of the eye samples revealed large tumour sizes, occupying either the entire eye or more than two-thirds of it. We also found significant optic nerve and choroid invasion by the tumour. Large tumour size at diagnosis, invasion of the optic nerve, and the choroid have been identified by previous studies as poor prognostic markers for retinoblastoma,[41,42] and these were all present in the inoculated specimens of the current study. Again, the clinical stage of diagnosis of any neoplastic lesion has been found to be an important predictor of prognosis and hence treatment outcome. In the current study, 50.0% of the confirmed retinoblastomas were of high TNM stage (II – III). The combined clinico-pathological features of patients diagnosed with retinoblastoma in the current study seem to suggest poor treatment outcomes, poor prognosis, reduced survival rate and death as reported decades ago in Ghana.[34,43]

Lymphoma

In the present study, lymphomas were found to be the fourth common malignancy, and more in the paediatric age group. This is in contrast to many previous publications in Africa that reported this lymphoid malignancy as the leading paediatric cancer.[2,4,5,9,38,44] However, the age pattern in the current study clearly supports those of previous studies that reported lymphomas as being common within the paediatric age group.[2,4,5,26,38,44,45]

The subtypes of lymphomas in descending order were: Burkitt's lymphoma (53.9%), diffuse large cell lymphoma (23.1%), Hodgkin's lymphoma (19.2%) and angio-immunoblastic lymphadenopathy (3.8%). This pattern is similar to reports in Africa.[2,4,44,45] For instance, Hammed *et al.,* in their study on the burden of Burkitt's lymphoma in Africa, reported a rate of 50.0%, close to the value in the current study in northern Ghana. This pattern, however, differs from Gupta et al., who reported leukemia as the commonest haematological malignancy in their study.[46]

Renal Tumour

The commonest histological subtype of renal cancer in this study was nephroblastoma (Wilms tumour) (83.1%, P<0.0001). Renal cancers were common in the paediatric age group (82.4%), particularly those within 0–4 years. The mean age was 7.6±5.6 years. The age characteristics of childhood and adolescent renal tumour reported in northern Ghana are closer to those reported in other parts of West Africa,[47,48] but higher than reports from other studies, also from Africa.[49,50] All the patients presented with intra-abdominal masses as reported in the study by Atanda *et al.,*[50] The sites of involvements were: left kidney 9 (52.9%), right kidney 6 (35.3%) and bilateral 2 (11.8%). The primary symptom of presentation and the laterality of renal cancer in childhood and adolescents in the current study are similar to that found in Atanda *et al.,* study in Northwestern Nigeria.[50]

Approximately, 61.5% presented to health facilities for management within 1–6 months of onset of the disease. The duration at presentation of childhood and adolescent cancers in our study is in line with those of previous studies in Africa.[50–52] The current study found majority (76.5%) of the patients with renal malignancies to be females (P<0.0001). This agrees with Abubakar *et al.,*[53] but differs from other studies in Africa that demonstrated a male predominance.[47,50,54]

CONCLUSION

Childhood and adolescent cancers were common in the pediatric age group with slight predominance in females. The common histological subtypes were: soft tissue sarcoma, primary bone cancer, retinoblastoma lymphoma and nephroblastoma. Many of the patients presented late with advanced diseases. There is the need to educate parents about these conditions to help with the early identification of symptoms, rapid diagnosis in health facilities, and prompt oncological care.

Limitations

1. In this study, diagnosis of childhood and adolescent cancers were based on H&E histological features, no case was histochemically confirmed.
2. Brain surgeries are not commonly conducted in the catchment areas and the prevalence as reported in this study may not be reflective of the exact burden of the disease.
3. Not all biopsy samples are reported in our department, some are reported in other centres outside Tamale.

Recommendations

Immunohistochemistry techniques are highly recommended as a confirmatory study for all soft tissue tumours, lymphomas and more so, the primitive pediatric (small round blue cell) tumours. There is thus the need to adequately resource the Pathology Department of the only Teaching Hospital serving the Northern part of the country.

There is the need to intensify health education on early detection, reporting and diagnosis of childhood and adolescent cancers, by parents, health care providers and Non-Governmental agencies involved in health policy development and other activities.

There is the need for early diagnosis and prompt and adequate management of all childhood and adolescent cancers by clinicians, pathologists, radiologists, oncologists and nurse oncologists. Provision of adequate and well-equipped health infrastructure in northern Ghana by the Government of Ghana is a necessity.

Posting of specialists and the initiation of residency training in northern Ghana by the Ministry of Health, Ghana Health Service and the Ghana College of Physicians and Surgeons.

Conflict of Interest

The authors have no conflict of interest.

Consent to publish this Data

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