Archives of Current Research International

20(8): 41-50, 2020; Article no.ACRI.66160
ISSN: 2454-7077

Pattern and Outcome of Childhood Cancer in Rivers State University Teaching Hospital

Tamunoiyowuna G. Okari[1,2*] , Boma A. West[1,2] and Woroma Wonodi[1,2]

[1]Department of Paediatrics and Child Health, Rivers State University, Nkpolu, Port Harcourt, Rivers State, Nigeria.
[2]Department of Paediatrics, Rivers State University Teaching Hospital, Port Harcourt, Rivers State, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. The research work was carried out by the three authors and they all participated in reading and approving the final draft of the manuscript.

Article Information

DOI: 10.9734/ACRI/2020/v20i830223
Editor(s):
(1) Ass. Prof. M. A. Elbagermi, Misurata University,Libya.
(2) Amal Hegazi Ahmed Elrefaei, Atomic Energy Authority, Egypt.
Reviewers:
(1) Amal Halim, Mansoura Univ, Egypt.
(2) Ashfaq Chandio, Luton & Dunstable University Hospital, UK.
Complete Peer review History: http://www.sdiarticle4.com/review-history/66160

Original Research Article

Received 25 October 2020
Accepted 30 December 2020
Published 31 December 2020

ABSTRACT

Introduction: Childhood cancer is on the increase globally with a heterogenous distribution in the type seen in different localities, age groups, and gender. So also, is the outcome of treatment variable in different countries and is dependent on the availability of funds, drugs, medical equipment among others.
Aim: To determine the pattern and outcome of childhood cancer in Rivers State University Teaching Hospital (RSUTH).
Methods: A 5-year retrospective study was carried out in RSUTH from January 2015 to December 2019. The case notes of all children aged 1-16years with diagnosis of childhood malignancy were retrieved and only those with histopathologic diagnosis of cancer and complete data were included in the study.
Results: Thirty-two children aged 1-16years, with a median age of 6years, 24 (75%) males and 8 (25%) females were recruited for the study. The median duration of symptoms was 3 months. Majority of the care givers (75%) were of low socio-economic class. Leukaemia 8 (25%) and lymphomas 5 (18.8%) were the common malignancies seen and 50% had metastatic disease at

**Corresponding author: Email: yogee007ng@gmail.com;*

presentation. Fever (62.5%), weight loss (56.3%) and pallor (46.9%) were common complaints given, while chemotherapy alone 5 (15.6%) or in combination with surgery 5 (15.6%) was the most given treatment. Three (9.4%) children completed treatment and are alive, 28.1% requested for discharge against medical advice and 28.1% died.

Conclusion: Leukemia and lymphomas are common forms of childhood malignancy in our facility. Majority of the caregivers were poor and unable to complete the required treatment of their children.

Keywords: Pattern; outcome; childhood cancer; Rivers state; malignancy; paediatric; Nigeria.

1. INTRODUCTION

Cancer is an important cause of morbidity and mortality in children and adolescents worldwide with about 300,000 children aged 0-14years being diagnosed annually [1] with more than 80% of them from the developing countries [2]. Even though cancers constitute a smaller burden compared to infectious diseases in developing countries, they are an emerging significant non-communicable disease challenge of public health significance [3]. The pattern of childhood cancers differs by age, sex, location and genetics among others. There has been an increase in diagnosis of cancers globally due to better techniques and environmental agents [3,4]. The cure rate of cancers in high income countries is 80% while it is 20% in developing countries [1]. The high death rate from childhood cancers in low-and-middle-income countries results from late presentation in health facilities, lack of diagnostic facilities, misdiagnosis or delayed diagnosis, unavailability of treatment facilities, abandonment of treatment when available, death from treatment toxicity, and higher rates of relapse [1,2].

The commonest childhood cancers are leukaemia, brain and spinal tumours, lymphomas and Wilms tumuor. Others include rhabdomyosarcoma, retinoblastoma and bone cancers [1].

The prevalence of cancers in children ranged from 1.4% in Ghana to 10.0% in Rwanda [5]. In Africa, reports from cancer registries showed that the solid tumours (lymphomas, nephroblastoma, Kaposi sarcoma and retinoblastoma) were the most common forms of childhood cancers unlike in the developed countries where hematologic malignancies like leukaemias were the most common [5].

The pattern and outcome of childhood cancer differ in various localities hence the need for local data in RSUTH, and provides a benchmark for reference and comparable data in the future. Besides, it also provides a means of developing a guiding framework for preventive and therapeutic interventions in childhood cancers. This study was therefore carried out to document the pattern and outcome of childhood cancers in the Rivers State University Teaching Hospital.

2. AIM

The aim of the study was to determine the pattern and outcome of childhood cancers in the Rivers State University Teaching Hospital from January 2015 to December 2019.

3. METHODOLOGY

This was a five-year retrospective descriptive study of children aged 1-16 years with clinical and histological diagnosis of cancer managed by the Haemo-Oncology unit of the department of Paediatrics, Rivers State University Teaching Hospital (RSUTH) from January, 2015 to December, 2019.

Rivers State, also known as the Treasure Base of the nation, is situated in the South-South geopolitical zone of Nigeria in West Africa [6]. It is bounded on the south by the Atlantic Ocean, on the north by Imo, Abia and Anambra States, on the east by Akwa Ibom State and on the west by Bayelsa and Delta States. The RSUTH is a 350-bedded State-owned tertiary facility which serves as a referral centre for private health facilities, Primary Health Centres, Secondary health facilities within and outside the state. The Paediatric Haem-oncology Unit is managed by a Consultant, Resident doctors and House Officers. The unit manages all children with cancers and offers chemotherapy, surgery, supportive and palliative care to patients with cancers and refers those who need radiotherapy and neurosurgery to appropriate centres outside the state.

The data used in this research were obtained from patients' case folders, histopathology and bone marrow aspiration forms. Patients' records were obtained from the records department. Each patient was characterized based on age at diagnosis, sex, socioeconomic status, marital

status of mother, birth order, location of residence (urban or rural), mode of referral, clinical presentation, means of diagnosis, modality of treatment, response to treatment and outcome. All children aged 1-16 years with a diagnosis of cancers from January 2015 to December 2020 with complete data with histologic diagnosis were included in the study. Those with incomplete records were excluded from the study.

Data was analyzed using IBM Statistical Package for Social Sciences (SPSS) statistical software version 23 and results presented in frequency tables, percentages and figures.

4. RESULTS

A total of 48 patients with childhood cancers were seen in the 5-year period under review (2015-2019). A total of 2364 children were admitted into the children medical ward during the period under review, giving a childhood cancer prevalence rate of 2%. Only 32 patients with complete records were included in the review. They included 24(75%) males and 8(25%) females with a male:female ratio of 3:1. They were aged 1-16 years with majority age 1-5 years 15 (46.7%), Table 1. The mean age was 6.67±4.65 years while the median age was 6years. Twenty (62.5%) were from urban communities, 24(75%) were from low socio-

Table 1. Socio-demographic characteristics of the study population

Parameters	Frequency (n=32)	Percent (%)
Age group (Years)		
1-5	15	46.7
6-10	10	31.3
>10	7	21.9
Gender		
Male	24	75
Female	8	25
Socioeconomic class		
Middle	8	25
Low	24	75
Birth order		
1	13	40.6
2	6	18.8
3	5	15.6
4	6	18.8
≥5	2	6.2
Marital Status of mothers		
Married	22	68.8
Single	6	18.8
Widow	2	6.2
Late	2	6.2
Location of residence		
Urban	20	62.5
Semi urban	5	15.6
Rural	7	21.9
Mode of referral		
Self	17	53.1
Hospitals	11	34.3
NGO	3	9.3
Neigbours	1	3.1

economic class and mostly of the first birth order 13(40.6%). The median and mean duration of symptoms before presentation were 3 months and 5.42±6.98 months respectively.

4.1 Type of Childhood Cancer in Study Population

The commonest malignancy was leukaemia 8 (25%), followed by the lymphomas. Of the 8 cases of acute leukaemia recorded in the study, 7 (21.9%) were acute lymphoblastic leukaemia and 1 (3.1%) acute myeloid leukaemia. Five children in the study had lymphoma, 3 (9.3%) were Burkitt lymphoma and I (3.1%) case each of Hodgkin lymphoma and Non-Hodgkin lymphoma. Of the four cases of retinoblastoma, 3 (9.3%) were located in the left eye and 1 (3.1%) in the right eye. There was no case of bilateral retinoblastoma. Other types of tumours found among children were one each of clear renal cell carcinoma, desmoplastic small round cell tumour, germ cell tumour, nasopharyngeal carcinoma and paraganglioma, Fig. 1. Sixteen (50%) children had evidence of metastatic disease at presentation.

Fever, 20 (62.5%) was the commonest presenting complaint seen among the study population, followed by weight loss 18 (56.3%) and pallor 15 (46.9%), Table 2.

Table 2. Common presenting complaints among children with childhood cancer

Symptoms	Frequency N (%)
Fever	20 (62.5)
Weight loss	18 (56.3)
Pallor	15 (46.9)
Abdominal mass	12 (37.5)
Swollen lymph nodes	10 (31.3)
Difficulty in breathing	7 (21.9)
Bone pain	6 (18.8)
Proptosis	5 (15.6)
Loss of vision	5 (15.6)
Eye discharge	5 (15.6)
Convulsion	5 (15.6)
Headache	5 (15.6)
Bleeding diathesis	5 (15.6)
Abdominal pain	4 (12.5)
Cough	4 (12.5)
Squint	3 (9.4)
Loss of developmental milestones	3 (9.4)
Sore throat	3 (9.4)

4.2 Treatment Received

All the children in the study population had supportive treatment as needed. Thirteen (40.4%) children received one form of definitive treatment or the other, 6 (18.8%) were referred for treatment in other facilities, 13 (40.4%) did not receive any definitive treatment before they died, absconded or requested for discharge against medical advice (DAMA). Table 3 shows that 5 (15.6%) received only chemotherapy.

4.3 Outcome of Children with Childhood Cancer

Of the 32 children studied, 3 (9.3%) completed treatment and were still alive, 9 (28.1%) died during admission and 6 (18.6%) referred to other centres for treatment, Fig. 2.

Table 3. Type of treatment received by the children with cancer

Mode of Treatment	Frequency N (%)
Chemotherapy	5 (15.6)
Chemotherapy & surgery	5 (15.6)
Chemotherapy, surgery and radiotherapy	2 (6.3)
Surgery	1 (3.1)
Palliative	7 (21.9)
Supportive only	12 (37.5)
Total	32 (100)

5. DISCUSSION

The prevalence of 2.0% documented in the present study was comparable to the 2.7% and 2.9% reported in Kano [7,8] northern Nigeria but much lower than the 7.7%, 9.1% and 10.9% reported in Zaria, [9] Sokoto [10] and Kano, [11] northern Nigeria respectively. These varying prevalence rates could be attributed to the varying geographic and ethnic differences as well as difference in environmental exposures. The very low prevalence documented in the present study could be due to the fact that the paediatric oncology unit in the RSUTH was created only six years ago and as such still evolving.

Males predominated in the present study with a M: F ratio of 3:1. Similar male predominance was documented in all other studies [7-10,12-20].

In the present study, childhood cancers were observed mostly in the age group 1-5years as also observed by Eke & Akani [13] in a previous

study carried out in Port Harcourt. Similarly, Fathi et al [18] in Iran documented predominance of childhood cancers in children aged 1-4 years, Ochicha et al [11] in Kano, northern Nigeria reported 0-4 years while Ahmad et al [9] and Irvine [20] in Zaria, northern Nigeria and United Kingdom respectively observed children less than 5 years as the commonest age group affected. Contrary to the above studies, Utuk & Ikpeme [12] in Uyo, southern Nigeria documented 5-10 years as the commonest age group affected, Shehu et al [8] in Ile-Ife 6-10 years and Yifru & Muluye [19] in Ethiopia documented ≥ 10 years as the commonest age groups affected. These differences can be attributed to the varying geographic locations with varying cancer prevalence rates.

Close to 2/3rd of the children with cancers were from urban communities. This is not surprising as the Rivers State University Teaching Hospital is situated in the state capital, an urban area and probably not within reach of those living in the rural areas as a result of high cost of transportation, the inconvenience of travelling long distance as well as poor terrain as seen in the Riverine areas of the state. This urban predominance was observed also by Fathi et al [18] in Iran.

Seventy-five percent of children who had cancers were of low socio-economic status in the present study. This was also the case in a multicentre study carried out Kano and Ile-Ife [8] in Nigeria. Similarly, a centre in Uganda [16] reported that majority of the mothers whose children had cancers were poorly educated with primary education being the highest level of education attained. Contrary to the present study however, a previous study in Port Harcourt [13] showed middle class as the predominant social class.

The commonest malignancy reported in the present study was leukaemia followed by Lymphoma, retinoblastoma and nephroblastoma. In India, [21] Leukaemia was also documented as the commonest malignancy followed by Lymphoma. Leukaemia being the commonest malignancy was also reported in Lagos [15] western Nigeria, Estonia, [17] United Kingdom, [20] Iran [18] and Namibia. [22] An earlier study in Port Harcourt [13] Nigeria however documented nephroblastoma as the commonest cancer implicated as also observed in Ethiopia. [19] Lymphoma was reported as the leading malignancy in Ghana [23] and Uganda, [7,16,24,25] retinoblastoma in Kano, [11] while rhabdomyosarcoma was documented in Sokoto, [10] Northern Nigeria. These variations could be attributable to geographic and ethnic differences.

Acute lymphoblastic leukaemia (ALL) was the commonest type of leukaemia followed by acute myeloid leukaemia in the present study. This pattern was also observed in Zaria, [9] northern Nigeria, Lagos, [15] western Nigeria, Estonia, [17] Iran [18] and Namibia [22].

Burkitt's lymphoma was the commonest lymphoma observed in the present study followed by Hodgkin's lymphoma. Burkitt's lymphoma was also the commonest type of lymphoma in Uyo [12] southern Nigeria, Kano [7] northern Nigeria and Ghana. [23] Contrary to the present study however, Non-Hodgkin's lymphoma was the commonest type of lymphoma in Ibadan [14] and Lagos, [15] western Nigeria whereas in Estonia, [17] Europe Hodgkin's lymphoma was the commonest type followed by Non-Hodgkin's lymphoma and Burkitt's lymphoma. These variations could also be as a result of ethnic and geographic variations and different levels of exposures to environmental toxins.

Chemotherapy alone was the most common treatment modality in the present study followed by combination of chemotherapy and surgery. This was also the treatment modality in Uyo [12] southern Nigeria while in Zaria, [9] northern Nigeria chemotherapy alone was the commonest form of treatment followed by supportive care alone whereas in a previous study in Port Harcourt [13] chemotherapy alone was followed by surgery alone as the commonest treatment modality. Radiation therapy which was observed to be quite low in most centres [9,12] was not done in the present study as well as the previous study carried out in Port Harcourt. [13] This could be because of the lack of paediatric radiation facilities in the southern parts of Nigeria as well as its high cost. The variations in the treatment modalities could be attributed to the differences in the prevalent cancer types in the various geographic locations and their varying facility treatment protocols as well as the available expertise and technological knowhow. It is worthy of note that all patients in the present study received supportive treatment. However, supportive treatment alone accounted for 37.5% while palliative treatment accounted for 21.9%. Palliative therapy was offered to only 1.6% of the patients in the previous study in Port Harcourt [13] and was not documented in other studies.

Only 9.3% of children with cancers completed their treatment and were alive by the end of the study period. This is not surprising as three-quarters of the study population were of the low socioeconomic class and thus were more likely to be poorly educated with possible financial constraints. This was comparable with the 8.0% reported by Mutyaba et al [16] in Uganda but higher than the 5.8%, 3.3% and 2.4% reported by Ahmad et al, [9] Eke & Akani, [13] Utuk & Ikpeme [12] in Zaria, Port Harcourt and Uyo, Nigeria respectively. It was however much lower than the 23%, 25% and 51.3% reported by Schroeder et al, [25] Akinsete et al [15] and Ibrahim et al [7] in Tanzania, Lagos, western Nigeria and Kano, northern Nigeria respectively. Interestingly, the survival rate in Estonia [17] in Europe was observed to increase from 23.8% between 1970-1979 to 73% by 2010-2016. Similarly, in the United Kingdom [20] 80% of children with cancers diagnosed between 2003 and 2007 survived for a minimum of 5 years and this rate increased significantly to 83% in 2008-2012. These varying survival rates may be attributable to the types of cancers prevalent in the different geographic areas, socioeconomic status of the different population, quality of health care, availability of health insurance and technological advancement. The very high survival rate in Estonia and United Kingdom, a high-income country could be attributed to better health care and technological advancement. It has been postulated however that 7-8 out of every 10 children with cancers in resource rich countries are cured unlike in resource poor countries [26,27].

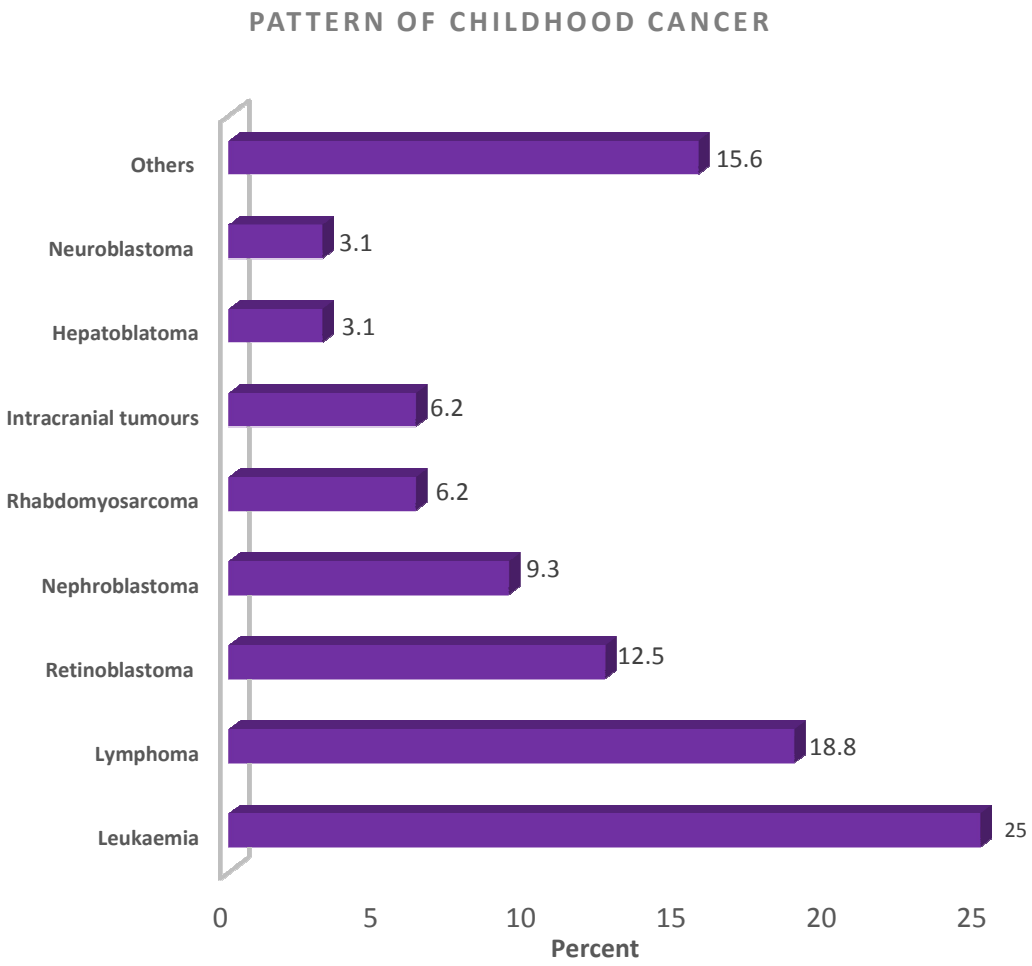

Fig. 1. Pattern of childhood malignancy in study population

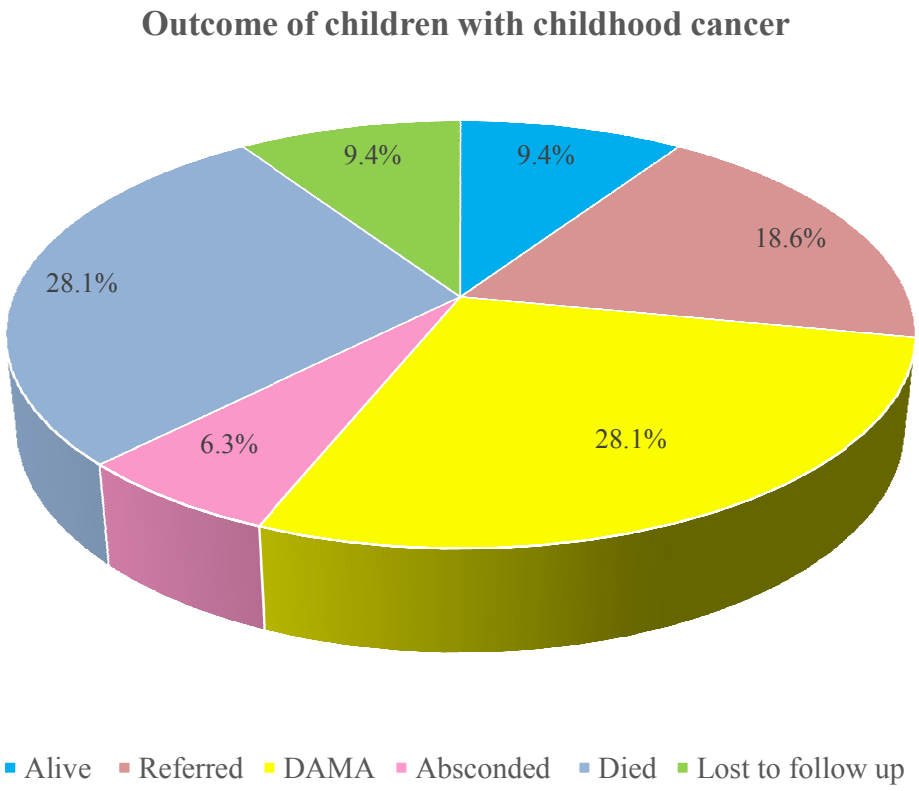

Fig. 2. Outcome of children with childhood cancer

The mortality rate in the present study of 28.1% was comparable to the 24% and 21.8% reported in Kano [7] northern Nigeria and Uyo [12] southern Nigeria respectively but lower than 32.2%, 43.4%, 45.5%, 46.3% and 48% reported in Zaria, [9] northern Nigeria, Port Harcourt [13] southern Nigeria, Lagos [15] western Nigeria, Uganda [16] and Tanzania [25] respectively. The high mortality observed in the above studies could be attributed to the poor health care, unavailability and very high cost of treatment, financial difficulties, unavailability of health insurance, belief for spiritual causes of illness by caregivers as well as late presentation of these children as observed in Zaria [9] and in the present study in which the mean duration of symptoms before presentation was 5.42 ± 6.98 months and a high proportion of children with cancers (50%) presented with metastatic disease. It is worthy of note that late presentation has been documented to be associated with increase in mortality. [28,29] It is however sad to note that more than 70% of cancer related mortalities in the world are recorded in resource poor settings [27].

The high Discharge against medical advice (DAMA) rate of 28.1% reported in the present study was similar to the 29.7% and 25% reported in Uyo [12] and Port Harcourt [13] southern Nigeria respectively but much higher than the 11.4% and 3.4% reported in Zaria [9] northern Nigeria and Lagos,[15] western Nigeria respectively. Reasons given for DAMA included financial constraint and long duration of hospital stay in a study. [19] Some other studies similarly documented varying treatment abandonment rates of 9.1%, 21.6%, 40% and 45.7% reported in Nigeria, [7,15] Tanzania [25] and Uganda [16] respectively. It is pertinent to note that factors associated with abandonment as documented by Mutyaba et al. [16] included maternal education below secondary level of education while Akinsete et al. [15] reported financial constraints and seeking traditional or spiritual help as the most common reasons for treatment abandonment. This finding was in keeping with report by Eke & Akani [13] in Port Harcourt who reported that 86% of children with cancers sort native treatment before presentation. This could be because in most developing countries,

cancers are still perceived as incurable and thus would not respond to orthodox treatment. This is also in line with the present study which found a mean duration of symptoms of 5.42 ± 6.98 months before presentation. Additionally, Yilfru & Muluye [19] documented a long duration of stay of children with cancers of up to 112days. This could also account for the high rates of discharge against medical advice and treatment abandonment.

Up to 9.4% of children on follow up of various cancers were lost to follow up in the present study. This was comparable to the 8.3% and 15.6% reported in Port Harcourt [13] and Kano [7] but much lower than the 38.1% and 52.6% documented in Uyo [12] and Zaria [9] respectively. These high rates are not unexpected as parents/caregivers during the treatment of their wards with cancer suffer from psychological trauma and get burnt out due to the long hospital stay and huge financial burden thus are likely to succumb to negative influences from relatives, friends, neighbours and their communities. This therefore calls for psychotherapy for parents/caregivers and affected children (especially adolescents).

6. CONCLUSION

The prevalence of childhood cancer in RSUTH is low, with leukaemias and lymphomas as the predominant types seen. Late presentation to the hospital is common. The high prevalence of cancer among children from low socioeconomic class who can't afford the exorbitant cost of cancer treatment is worrisome.

It is therefore important to incorporate full childhood cancer treatment in health insurance schemes, make cancer drugs cheap, available and accessible, in addition to upgrading health facilities to provide technologically advanced treatment options for children with cancer. Furthermore, the provision of funds for research and treatment of childhood cancer, and educating caregivers on the importance of early presentation to health facilities will greatly improve the outcome of childhood malignancies.

ETHICAL APPROVAL

Ethical clearance was obtained from the Rivers State Health Research Ethics Committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Steliarova-Foucher E, Colombet M, Ries L, Moreno F, Dolya A, Bray F, et al. International incidence of childhood cancer, 2001-10: A population-based registry study. Lancet Oncol. 2017;18(6): 719-731.
   DOI:10.1016/S1470-2045(17)30186-9
2. Kaatsch P. Epidemiology of childhood cancer. Cancer Treat Rev. 2010;36:277-85.
   DOI: 10.1016/j.ctrv.2010.02.003.
3. Sloan FK, Gelband H. Cancer control opportunities in low-and middle-income countries. Committee on Cancer in Low- and Middle-countries Board on Global Health. The National Academics Press; 2007.
   Available:http://www.nap.edu
   Accessed: January 2021.
4. Johnston WT, Lightfoot TJ, Simpson J, Roman E. Childhood cancer survival: A report from the United Kingdom childhood cancer study. Cancer Epidemiol 2010;34: 659-66.
   DOI:10.1016/j.canep.2010.06.020
5. Stefan CD. Patterns of distribution of childhood cancer in Africa. J Trop Pediatr. 2015;61:165-73.
   Available:https://doi.org/10.1093/tropej/fmv005
6. Wikipedia. Geography of Rivers State. Available:https://www.wikepedia.org/wiki/Rivers_State Accessed 18/01/2021.
7. Ibrahim M, Abdullahi SU, Hassan-Hanga F, Atanda A. Pattern of childhood malignant tumors at a teaching hospital in Kano, northern Nigeria; a prospective study. Indian J Cancer. 2014;51(3):259-261.
   DOI: 10.4103/0019-509X.146765
   PMID:25494118
8. Shehu UA, Adegoke SA, Abdulsalam U, Ibrahim M, Oyelami OA, Adeodu OO. Pattern of childhood malignant tumours in two tertiary teaching hospitals in Nigeria: Comparative study. Niger J Paed. 2013; 40(2):175-178.
   DOI: http://dx.doi.org/10.4314/njp.V40;2,14

9. Ahmad HR, Frank JA, Abdullahi M, Olorunkooba AA, Ishaku H, Abdullahi FL, et al. Pattern and outcomes of childhood malignancies at Ahmadu Bello University Teaching Hospital, Zaria. Sub-Saharan Afr J Med. 2016;3(3):127-131.
DOI: 10.4103/2384-5147.190836
10. Sahabi SM, Abdullahi K, Lukong CS, Agbo SP. Solid tumours of childhood in Sokoto, Nigeria. World J Res Rev. 2017;4(4): 4-9.
11. Ochicha O, Gwarzo AK, Gwarzo D. Pediatric malignancies in Kano, Northern Nigeria. World J Pediatr. 2012;8:235-239.
DOI: 10.1007/s12519-012-0363-3
12. Utuk EE, Ikpeme EE. Childhood cancers in a referral hospital in South-South Nigeria: A review of the spectrum and outcome of treatment. Pan Afr Med J. 2015; 22:325.
DOI: 10.11604/pamj.2015.22.325.6990
13. Eke GK, Akani N. Outcome of childhood malignancies at the University of Port Harcourt Teaching Hospital: A call for implementation of palliative care. Afr Health Sci. 2016;16(1):75-82.
14. Babatunde TO, Akang EEU, Ogun GO, Brown BJ. Pattern of childhood cancer in University College Hospital, Ibadan during 1991-2010 and comparison with the previous three decades. Paediatr Inter Child Health. 2015;35(2):144-150.
Available:https://doi.org/10.1179/2046905514Y.0000000132
15. Akinsete AM, Awofeso OM, Akere ZA, Akinsulie AO. Teniye CA. Pattern of presentation, treatment and determinants of outcome of pediatric oncology cases at a tertiary institution in Lagos. J Clinical Sci. 2018;15(3):136-139.
DOI: 10.4103/jcls_15_18
16. Mutyaba I, Wabinga HR, Orem J, Casper C, Phipps W. Presentation and outcome of childhood cancer patients at Uganda Cancer Institute. Global Pediatr Health 2019;6:1-12.
DOI: 10.1177/2333794X19849749.
17. Paapsi K, Saks K, Innos K. Childhood cancer incidence and survival trends in Estonia (1970-2016): A nationwide population-based study. BMC Cancer. 2020;30.
Available:https://doi.org/10.1186/s12885-019-6510-7
18. Fathi A, Bahadoram M, Amani F. Epidemiology of childhood cancer in Northwest Iran. Asian Pac J Cancer Prev. 2015;16(13):5459-5462.
DOI: 10.7314/apjcp.2015.16.13.5459
19. Yilfru S, Muluye D. Childhood cancer in Gondar University Hospital, Northwest Ethiopia. BMC Res Notes. 2015;8: 474.
Available:https://doi.org/10.1186/s13104-015-1440-1
20. Irvine L. Childhood cancer statistics- what can we learn from new data; 2017.
Available:publichealthmatters.blog.gov.uk/2017/02/01/childhood-cancer-statistics-what-can-we-learn-from-new-data/
Assessed: 13/01/2021
21. Satyanarayana L, Asthana S, Labani SP. Childhood cancer incidence in India: A review of population-based cancer registries. Indian Pediatr. 2014;51(3):218-220.
DOI: 10.1007/s13312-014-0377-0
22. Stefan DC, Baadjes B, Kruger M. Incidence of childhood cancer in Namibia-the need for registries in Africa. Pan Afr Med J. 2014;17:191.
DOI: 10.11604/pamj.2014.17.191.3830
23. Paintsil A, Blay Nguah S, Osei-Akoto A, Osei-Tutu L, Hammond C. Pattern of childhood cancers presenting to the paediatric cancer unit of a tertiary hospital in Kumasi, Ghana. J Cancer Prev Curr Res. 2015;3(3):00083.
DOI: 10.15406/jcpcr.2015.03.00083
24. Abila DB. Comparison of current trends of incidence of childhood and adolescent cancers in Sub-Saharan Africa and international incidences, 2009 to 2014. Pediatr. 2018;142.
DOI:https:/doi.org/10.1542/peds.142.1_Meeting Abstract.518
25. Schroeder K, Saxton A, McDade J, Chao C, Masalu N, Chao C, et al. Pediatric cancer in Northern Tanzania: Evaluation of diagnosis, treatment and outcomes. J Glob Oncol. 2016;4(4):009027.
DOI: 10.1200/JGO.2016.009027
26. Gatta G, Zigon G, CapocacciaR, Coebregh JW, Desandes E, Kaatsch P, et al. Survival of European children and young adults with cancer diagnosed 1995-2002. Eur J Cancer. 2009;45:992-1005.
27. Magrath I, Bey P, Shad A, Sutcliffe S. Cancer funding in developing countries: The next health-care crisis? Lancet. 2010; 376:1827.
28. Nnebe U, Onwasigwe C. Childhood malignancy in Abakaliki: A growing concern. J Coll Med. 2005;10:21-25.

29. Brown BJ, Ajayi SO, Ogun OA, Oladokun RE. Factors influencing time to diagnosis of childhood cancer in Ibadan, Nigeria. Afr Health Sci. 2009;9(4):247-253.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/66160