MEDIRES
Symbol of Quality Research

Archives of Gynaecology and Women Health
info@mediresonline.org

ISSN: 2836-497X RESEARCH ARTICLE

Nephroblastoma (Wilms' Tumor): Sex and Age Distribution and Correlation Rate with Ages, Sex, And Kidney Side in Sana'a City,Yemen

Amin Abdulkarem Okbah[1,2], Hassan Abdulwahab Al-Shamahy*[3,4]

[1]*Department of Histopathology, Faculty of Medicine and Health Sciences, Sana'a University, Republic of Yemen.*

[2]*Department of Histopathology, National Center for Public Health Laboratories (NCPHL). Ministry of Health and Population, Republic of Yemen*

[3]*Medical Microbiology and Clinical Immunology Department, Faculty of Medicine and Health Sciences, Sana'a University, Republic of Yemen.*

[4]*Medical Microbiology Department, Faculty of Medicine, Genius University for Sciences and Technology, Dhamar City, Republicof Yemen.*

***Corresponding Author:** Hassan Abdulwahab Al-Shamahy, Medical Microbiology and Clinical Immunology Department, Faculty of Medicine and Health Sciences, Sana'a University, Republic of Yemen, Medical Microbiology Department, Faculty of Medicine, Genius University for Sciences and Technology, Dhamar City, Republic of Yemen.

Received: 17 August 2022 **Accepted:** 22 November 2022 **Published:** 14 December 2022.

Citation: Amin. A. O, Hassan. A. Al-S., (2022). Nephroblastoma (Wilms' Tumor): Sex and Age Distribution and Correlation Rate with Ages, Sex, And Kidney Side in Sana'a City, Yemen. Archives of Gynaecology and Women Health. 1(1); DOI: 10.58489/2836-497X/001.

Abstract

Wilms' tumor is a malignant tumor that contains metanephric blastema, stromal and epithelial derivatives. The characteristic is the presence of abortive tubules and glomeruli surrounded bythe stroma of a spindle cell. The stroma may include striated muscle, cartilage, bone, adipose tissue, and fibrous tissue. The study aimed to describe the age, sex, and histology distribution of Wilms' tumor and its association with age groups, sex, and the side affected by the kidneys. A retrospective observational study was performed on renal masses patients who were consequently diagnosed selectively by histopathological study in the National Center for Public Health Laboratories (NCPHL) at the Department of Pathology, and the Department of Pathology in Al-Thorah university hospital, Sana'a, Yemen, over a period of 18 years from January 1, 2004, to December31, 2021. Data were collected from hospital records. The study variables were lesions histological types,benign, malignancy, non-neoplastic lesions, sex, grades, and age. The whole data were analyzed by IBMSPSS Statistics 22. Ink. The outcomes for variables were given in the form of rates (%). Chi-Square wasused for categorical variables that measured association among categorical variables. *P*-values less than 0.05 were considered significant. Wilms tumors count 47/282 (16.7%) of total diagnostic malignant tumors. The female caseswere 29/47 (61.7%) more than male cases 18/47 (38.3%) with M: F ratio equal to 1.0: 1.6. The mean ageof the Wilms' patients was 5.3 years with SD equal to 3.6 years and ages ranged from 9 months to 15 years. Most of the Wilms patients were in the age group 1-5 years 31/47(66%) followed by 6-10 years (25.5%). Favorable histology (FVH) Wilms' tumors with better prognosis counting 42/47 (89.4%) while unfavorable histology (UFVH) with poor prognosis only counting 5/47 (10.6%). There was no significant association between Wilms' tumor and gender while there was a highlysignificant association of Wilms' tumor in the 1-5 years group (rate = 77.5%, OR=48.6, CI =19.8-119,p <0.001) and with 6-10 years group (rate= 80%, OR=26.6, CI=7.1 – 98.7, p <0.001). There was no significant association between Wilms' tumors with the kidney side in which roughly equal rates were present in both sides. Wilms' tumors in Yemeni children appear at an early age and peak in the first 5 years of life with an increased incidence among females with predominantly FVH. The current study provided much-needed information about the burden of Wilms' cancer in Yemen, to enable Yemen to better planto address the burden. Further studies are necessary to determine the exact incidence and trend of Wilms' cancer and risk factors in Yemen.

Keywords: *children's cancers, kidney cancers, Sana'a city, Wilms' tumor (WT), degree of anaplasia*,

Introduction

Nephroblastoma, or Wilms' Tumor (WT), is an embryonic tumor of renal origin and is the most common genitourinary malignant tumor in children [1]. Overall, WT accounts for 7% of all childhood cancers and 90% of all pediatric tumors of the kidney [2]. WT is mostly unilateral however bilateral WT occurs in about 5% to 8% of patients [3]. In adults, WT accounts for less than 1% of all renal tumors [4]. Wilms' tumor affects 1 in 10,000 people worldwide before the age of 15 years [5]. People of African descent may have slightly higher rates of Wilms' tumor [5]. The maximum peak age of a Wilms tumor is 3 to 4 years and most cases occur before the age of 10 years. In Yemen, there are only some special epidemiological studies devoted to malignancies [6-13], although more research has been done on infectious and metabolic disorders in the past [14-22].

Wilms' tumor has many causes, which can generally be classified as syndromic and non-syndromic. The cause of Wilms tumor syndrome is caused by changes in genes such as the Wilms tumor 1 (WT1) genes or the Wilms tumor 2 (WT2) genes, and the tumor appears with a range of other signs and symptoms. Non-syndromic Wilms' tumor is not associated with additional symptoms or diseases. Many cases of Wilms' tumors develop from the anastomosis of the kidneys. Kidney pads are fragments of tissue in or around the kidney that arose before birth and turned into precancerous masses after birth. Cases of bilateral Wilms' tumor, in addition to cases of Wilms' tumor consequent from certain genetic syndromes for instance Denis-Drash syndrome, are generally closely associated with renal metastases. In cases of malignancy, it usually spreads to the lung. The rupture of a Wilms tumor puts the patient at risk of bleeding and the spread of peritoneal cancer cells. In such cases, surgical intervention by an experienced surgeon is necessary to remove such a fragile tumor [23,24].

The clinical presentation of WT usually includes an asymptomatic abdominal mass revealed incidentally by the parent, caregiver, or primary care physician. Other, non-specific clinical features include microscopic or gross hematuria, hypertension, abdominal pain, and fever [25]. Imaging tests for a WT scan entail an abdominal ultrasound, computed tomography (CT) scans and magnetic resonance imaging (MRI). However, CT scans should be carried out with concern in children due to the long-term negative effects of radiation in children. Treatment for WT includes surgery and chemotherapy with or without radiation therapy. There are two treatment protocols for WT: the Children Oncology Group-National Wilms' Tumor Study Group (COG-NWTSG) protocol for primary surgery and the SIOP (International Society for Pediatric Oncology) protocol for advanced chemotherapy. Although there are many studies on WT conducted globally, there is a paucity of studies on WT in Sana'a, Yemen. Hence, we conducted this study aimed to describe the age, sex, and histology distribution of the Wilms tumor and its association with age groups, gender, and the kidney effected side; during the past eighteen years, based on data from two main pathology examination centers in Sana'a city, Yemen.

Subjects And Methods

A study designed: Retrospective descriptive study.

Study site: The unit of cancer in Al-Thorah University Hospital and the National Center for Public Health Laboratories (NCPHL) in the Departments of Pathology in Sana'a City which serve the major government hospitals and private hospitals in the city of Sana'a and act as reference laboratories for the entire country.

Study population: The study was conducted on renal lesion patients (patients are usually referred from hospitals for histological diagnosis) who were subsequently diagnosed selectively by histo-pathological study in the Department of Pathology at the National Center for Public Health Laboratories (NCPHL) and the unit of cancer in Al-Thorah University hospital Sana'a, Yemen, over a period of about 18 years from January 1, 2004, to December 31, 2021.

Operational variables: The cancer was classified according to the results of the tissue examination preserved in the paper records of each case before its entry into the SPSS program. The entry was reviewed by three different people to reduce the error during the entry of the collected data - and the sample size was determined by the number of patients diagnosed in the two selected units in the period between 2004 Until 2021, and the quality of the data was censured by excluding any record of patients who lacked any of the variables on which the research was based on.

Study variables and cancer classification: The variables of the study were the histological type of cancer, sex, grade, and age. Types, grades, and histological diagnoses were formed in line with the World Health Organization [26] and "Kidney Cancer, Version 2.2017,

NCCN Clinical Practice Guidelines in Oncology" [27].

Inclusion criteria: Inclusion criteria for patients included the following: complete renal histo-pathological findings, patients of any age and gender, availability of clinical data, and histological slides that confirm the diagnosis of kidney lesions and cancers.

Exclusion criteria: Patients with no histopathological slides and insufficient clinical data in the records were excluded.

Statistical analysis: Data were reported using suitable descriptive statistics (consisting of mean, frequency, standard deviation, *OR*, *CI*, *X*2, and *P*-value). First data were entered using the SPSS software to minimize errors. All statistical analyzes of the data were performed using the Statistical Package for Social Sciences (SPSS) version 24 and Excel 2007.

Ethical approval: From the Faculty of Medicine and Health Sciences at Sana'a University, the Research and Ethics Committee with a reference number (811) dated 10-01-2022, the ethical approval was obtained. Also, all data, including patient identification, have been kept confidential.

Results

Malignant tumors counting 177/282 (62.8%) of the total kidney lesions, renal cell carcinoma (RCC) was the most predominant cancer counting 126/282 (44.7%), followed by Wilms tumors 47/282 (16.7%), while non-Hodgkin's lymphoma counting 3 cases (1.1%) and mucinous carcinoma one case (0.35%) (Table 1). Table 2 shows the sex and age distribution of 47 Wilms patients. The female cases were 29/47 (61.7%) more than male cases 18/47 (38.3%). The mean age of the Wilms' patients was 5.3 years with SD equal to 3.6 years and ages ranged from 9 months to 15 years. Most of the Wilms' patients were in the age group 1-5 years 31/47(66%) followed by 6-10 years (25.5%), while in less than 1 year and >10 years groups there were only 2 cases (4.2%) in each group. Based on the degree of anaplasia in histology, Wilms tumor is divided into favorable histology and unfavorable histology, FVH, and UFVH, respectively. Table 3 shows the histology distribution of renal Wilms tumors among 47 children's patients; FVH Wilms tumors counted 42/47 (89.4%) while UFVH only counted 5/47 (10.6%). There was no significant association between Wilms' tumor and sex as there are approximately equal rates in both sexes. Considering the age groups, there was a highly significant association of Wilms tumor with the 1–5-year group where the rate was 77.5% with OR = 48.6, CI = 19.8-119, p < 0 xss=removed xss=removed>.

Table 1: The distribution of different malignant tumors diagnosed between 2004-2022 in two centers in Sana'a, Yemen

Renal Lesions	Number	%
Malignant tumors	**177**	**100**
Renal cell carcinoma	*126*	*71.2*
Wilms tumor	*47*	*26.6*
Non-Hodgkin's lymphoma	*3*	*1.7*
Mucinous carcinoma	*1*	*0.6*

Table 2: Sex and age distribution of 47 Wilms tumor patients in Sana'a, Yemen

Characters	Number	%
Gender M:F ratio = 1.0: 1.6		
Male	*18*	*38.3*
Female	*29*	*61.7*
Age groups		
Less than 1 year	*2*	*4.2*
1-5 years	*31*	*66*
6-10 years	*12*	*25.5*
>10 years	*2*	*4.2*
Total	***47***	***100***
Mean age	*5.3 years*	
SD	*3.6 years*	
Min	*9 months*	
Max	*15 years*	
Mode	*1 years*	
Median	*5 years*	

Table 3: The histology distribution of renal Wilms tumor among 47 children's patients in Sana'a, Yemen.

Histology	Number	%
FVH	*42*	*89.4*
UFVH	*5*	*10.6*
Total	*47*	*100*

Table 4: The association between Wilms tumor (WT) with sex and ages among 282 renal lesions patients in Sana'a city, Yemen.

Characters		WT n=47 No (%)	OR	CI 95%	X^2	P
Gender						
Male n=124		*18(14.5)*	*0.7*	*0.39-1.4*	*0.73*	*0.39*
Female n=158		*29 (18.4)*	*1.3*	*0.65-2.5*	*0.73*	*0.39*
Age groups						
Less than 1 year	*n=2*	*2 (100)*	*undefined*	*undefined*	*10.1*	*0.001*
1-5 years n=40		*31(77.5)*	*48.6*	*19.8-119*	*124*	*<0.001*
6-10 years n=15		*12 (80)*	*26.5*	*7.1-98.7*	*45.7*	*<0.001*
>10 -15 years n=12		*2(16.7)*	*1*	*0.2-4.7*	*0.0*	*1.0*
Kidney side						
Right n=140		*27 (19.2)*	*1.4*	*0.77-2.7*	*1.37*	*0.24*
Left n=142		*20(14.2)*	*0.7*	*0.37-1.3*	*1.2*	*0.26*
Total n=282		**47(16.7)**				

OR = odd's ratio, *CI* 95% = confidence interval 95%, X^2 = Chi square, *p*= p value

Discussion

WT is the second most common intra-abdominal malignancy in children after neuroblastoma and WT arises from foci of persistent meta-nephric cells referred to as nephrogenic rests [25,28]. The formation of collaborative study groups and multimodal therapy has led to significant progress in the management of WT [29]. However, in developing countries, late presentation, malnutrition, poverty, and lack of multidisciplinary cooperation affect treatment outcomes for children with WT [30,31]. The two comprehensive collaborating groups that studied WT were the Pediatric Oncology Group (COG) and the International Society of Pediatric Oncology (SIOP). In the current study, female cases were 29/47 (61.7%) more than male cases 18/47 (38.3%) (Table 2). The predominance of females recorded in this study is in agreement with the reports of Breslow *et al.* [32] and Kaste *et al.* [33] where female children were more prevalent in Wilm's tumors than male patients. However, Hadley *et al*. [31] and Davidson *et al.* [34] studies in Africa did not agree with current findings indicating a nearly identical incidence of Wilm's tumor in both sexes. Male/female predominance may depend on the geographical area of study. In the current study, the mean age of the Wilms patients was 5.3 ± 3.6 years and the patient's ages ranged from 9 months to 15 years; most of the Wilms patients were in the age group 1-5 years (66%) (Table 2). The present results differ from those reported by Breslow et al. [32] as there is no significant tendency for WT between the sexes; Its incidence and mean age at diagnosis are 1 in 10,000 and 3.5 years, respectively [32]. The mean age of 5.3 ± 3.6 years reported in the current study is also slightly older than the mean age of 4.5 years recently reported by Chukwubuike [23]. On the other hand, the current mean age of 5.3 ± 3.6 years is similar to that reported by Elayadi, *et al*. [35] in Egypt with an average age of 5.25 years. In the current study, two cases of WT were >10 years old (4.2%) (Table 2). This is again similar to Osuoji *et al.* [36] who reported a case of Wilms' tumor in a 12-year-old Nigerian female [36]. These differences can be explained by differences in race. It took an average of 6 months from the time the abdominal mass was noticed to the time the parents were presented to the hospital. This late presentation may explain why most of our patients (89.4%) have FVH Wilms tumors. Poverty and ignorance prevailing in developing countries can explain this late presentation [23]. The majority of our patients presented with FVH Wilms tumor with a better prognosis similar to other studies conducted in developing countries [37,38]. While UFVH Wilms tumor of poor prognosis was found in only 5 cases (10.6%). We found more right-sided WT than left-sided tumors (27 vs 20). This result differs from the report of Chukwubuike [23] and Ledlie *et al.* [39] where they found more left-sided WT than right-sided tumors. However, Wilde *et al*. [40] in

their series reported more right WT than left WT and this is similar to the results of our study. The reason for these differences is still unknown.

Limitations of the study

This study was limited by the small number of cases. A larger number of cases would have availed better analysis. This was a retrospective study. A perspective would have provided more information. Gene analyses of the patients were not done due to the non-availability of the necessary facilities.

Conclusion

WT is still associated with significant morbidity and mortality in resource-limited environments. Wilms tumors in Yemeni children appear at an early age and its peak in 1-5 years of life with an increased incidence among females with predominant FVH than UFVH. The current study provided much-needed information about the burden of Wilms cancer in Yemen, to enable Yemen to better plan to address the burden. Further studies are necessary to determine the exact incidence, trend of Wilms cancer, and risk factors in Yemen.

Author Contribution

This study was completed by Amin Abdulkarem Okbah, Professor of Histopathology at Sana'a University, and the National Center of Public Health Laboratories (NCPHL) Sana'a, Yemen; and Prof. Dr. Hassan Abdul-Wahab Al-Shamahy, Faculty of Medicine, Sana'a University. All authors analyzed the data, wrote the manuscript, and reviewed it.

Acknowledgment

The authors would like to acknowledge the National Center of Public Health Laboratories (NCPHL) Sana'a, and Al-Thorah University Hospital, Yemen which supported this work.

Conflict Of Interest

"No conflict of interest associated with this work".

References

1. Lopes RI, Lorenzo A (2017). Recent advances in the management of Wilms' tumor. F1000Res. May 12; 6:670. doi: 10.12688/f1000research.10760.1.
2. Pastore G, Znaor A, Spreafi co F, et al. (2006). Malignant renal tumours incidence and survival in European children (1978-1997): report from the Automated Childhood Cancer Information System project. Eur J Cancer. Sep;42(13):2103-14. doi: 10.1016/j.ejca.2006.05.010. PMID: 16919774.
3. Ritchey ML, Shamberger RC, Hamilton T, Haase G, et al. (2005). Fate of bilateral renal lesions missed on preoperative imaging: a report from the National Wilms Tumor Study Group. J Urol. Oct;174(4 Pt 2):1519- 21; discussion 1521. doi: 10.1097/01.ju.0000179536. 97629.c5. PMID:16148643.
4. Segers H, van den Heuvel-Eibrink MM, Pritchard-Jones K, et al. (2011). Renal Tumour Committee. Management of adults with Wilms' tumor: recommendations based on international consensus. Expert Rev Anticancer Ther. Jul;11(7):1105-13. doi: 10.1586/era.11.76. PMID: 21806333.
5. Breslow N, Olshan A, Beckwith JB, Green DM (1993). "Epidemiology of Wilms tumor". Medical and Pediatric Oncology; 21 (3):
6. Okbah AA, Al-Shamahy HA, Al-Shamahi EH, Al-Ankoshy AAM (2022). Renal lesions: Differentiation of malignant and benign tumors, sex and age distribution and variables associated with renal cell carcinoma in Sana'a City, Yemen. Universal Journal of Pharmaceutical Research; 7(2):34-39.
7. Al-Samawi AS, Aulaqi SM (2013). Urinary bladder cancer in Yemen. Oman Med J.;28(5):337-340. doi:10.5001/omj.2013.97.
8. Okbah AA, Al-Ankoshy AAM, Al-Shamahy HA (2021). Bladder cancer: Bladder cancer: differentiation of types, age, sex distribution and associated variants with gradation. Universal Journal of Pharmaceutical Research; 6(6):57-64.
9. El-Zine MAY, Alhadi YA, Ishak AA, Al-Shamahy HA (2021). Prevalence of Different Types of Leukemia and Associated Factors among Children withLeukemia in Children's Cancer Units at Al-Kuwait Hospital, Sana'a City: A Cross-Sectional Study. Glob J of Ped & Neonatol Car. 3(4): 2021. GJPNC.MS.ID.000569. DOI: 10.33552/GJPNC.2021.03.000569.\
10. Alhadi AM, El-Zine MAY, IshaK AA, Al-Shamahy HA (2021). "Childhood Leukemia in Yemen: The Main Types of Childhood Leukemia, its Signs and ClinicalOutcomes". EC Paediatrics; 10.6 (2021): 75-82.
11. Al-Maktari L AS, Al-Nuzaili MAK, Al-Shamahy HA,

Al-Hadi AA, Ishak AA, et al., (2021). Distribution of Hematological Parameters Counts for Children withLeukemia in Children's Cancer Units at Al-Kuwait Hospital, Sana'a City: A Cross-Sectional Study. Adv Can Res & Clinical Imag. 3(2): 2021. ACRCI.MS.ID.000560. DOI: 10.33552/ACRCI.2021.02.000560.

12. El-Zine M AY, Ali MAA, Al-Shamahy HA (2021). "Prevalence of CNS tumors and histological recognition in the operated patients: 10 years experience in Yemen". Universal Journal of Pharmaceutical Research; 6, (2): 20-27.
13. Alfalahi S, Baadani THA, Babakri M, et al. (2016). Renal cell carcinoma in Yemeni patients: a review of 67 cases. Urol Nephrol Open Access J.;3(2):67- 71. DOI: 10.15406/unoaj.2016.03.00075
14. Al-Shamahi EY, Muhsin NM, Al-Shamahi EH, Al-Shamahy HA (2022). Patterns of uveitis at a tertiary referral center in Yemen: One central retrospective study. Universal Journal of Pharmaceutical Research; 7(2):1-6. DOI: https://doi.org/10.22270/ujpr.v7i2.743.
15. Al-Eryani SA, Alshamahi EYA, Al-Shamahy HA, Alfalahi GHA, Al-Rafiq AA (2021). Bacterial conjunctivitis of adults: causes and ophthalmic antibiotic resistance patterns for the common bacterial isolates. Universal J Pharm Res; 6(1):25- 28.
16. Alshamahi EYA, Al Shamahy HA, Al Nahary AA, et al. (2019). Epidemiology and aetiological diagnosisof corneal ulceration in Sanaa City, Yemen. W J Opthalmol Vision Res; 2(5):1-6.
17. Alshamahi EYA, Al-Eryani SA, Al-Shamahy HA, et al. (2021). Prevalence and risk factors for Trachoma among primary school children in Sanaa city, Yemen. Universal J Pharm Res; 6(4):19-25.
18. Abu-Hurub AS, Okbah AA, Al-Dweelah HMA, Al-Moyed KA, Al-Kholani AIM, Al-Najhi MMA, Al-Shamahy HA (2022). Prevalence of visceral leishmaniasis among adults in Sana'a city-Yemen. Universal Journal of Pharmaceutical Research; 7(2):21-26.
19. Al-Hrazi RMA, Al-Shamahy HA, and Jaadan BM (2019). Determination of rifampicin mono-resistance Mycobacterium tuberculosis in the National tuberculosis control programme in Sana'a city-Yemen: A significant phenomenon in war region with high prevalence tubercloisis. Universal JPharm Res; 4(3):1-6.
20. Alastot EM, Al-Shamahy HA (2018). Prevalence of leptospirosis amongst slaughterhouse workers andbutchers in Sana'a city-Yemen. Universal J Pharm Res; 3(2): 17-20.
21. Sheiban AA, Al-Shamahy HA, Alattab NM et al. (2017). Epidemicity of Vibrio cholera in Sana'a city, Yemen: prevalence and potential determinants. Universal J Pharm Res; 2(6): 1-6.
22. Al-Shamahy H, Whitty C, Wright S (2000). Risk factors for human brucellosis in Yemen: A case control study. Epidemiol Infection; 125(2): 309-313.
23. Chukwubuike KE (2021). Nephroblastoma: Profile and Management Outcome in a Tertiary Hospital ina Developing Country. Int J Nephrol Ther. ;7(1): 004-009. doi: 10.37871/ijnt.id30
24. Chukwubuike KE, Odetunde OA, Ohayi RS, Ogbuka FN (2019). Nephroblastoma with Spinal metastasis in a 12-year-old Nigerian female. MOJ Clin Med Case Rep; 9(6): 142-144. doi:10.15406/mojcr.2019.09.00324.
25. Davidoff AM (2012). Wilms tumor. Adv Pediatr.;59(1):247-67. doi: 10.1016/j. yapd.2012.04.001. PMID: 22789581; PMCID: PMC3589819.
26. Lopez-Beltran A, Scarpelli M, Montironi R, Kirkali Z(2006). "2004 WHO classification of the renal tumors of the adults". European Urol ; 49 (5): 798–805.
27. Motzer RJ, Jonasch Eric, Agarwal N, et al. (2017). Kidney Cancer, Version 2.2017, NCCN Clinical Practice Guidelines in Oncology. J National Comp Cancer Network ;15(6): 804-834.
28. Beckwith JB, Kiviat NB, Bonadio JF (1990). Nephrogenic rests, nephro-blastomatosis, and the pathogenesis of Wilms' tumor. Pediatr Pathol.;10(1- 2):1-36. doi:10.3109/15513819009067094. PMID: 2156243.
29. Gleason JM, Lorenzo AJ, Bowlin PR, Koyle MA (2014). Innovations in the management of Wilms' tumor. Ther Adv Urol.;6(4):165-76. doi:10.1177/1756287214528023. PMID: 25083165;PMCID: PMC4054506.

30. Israels T, Borgstein E, Pidini D, et al. (2012). Management of children with a Wilms tumor in Malawi, sub-Saharan Africa. J Pediatr Hematol Oncol.;34(8):606-10. doi:10.1097/MPH.0b013e3182580921. PMID:22767130.

31. Hadley LG, Rouma BS, Saad-Eldin Y (2012). Challenge of pediatric oncology in Africa. Semin Pediatr Surg.;21(2):136-41. doi: 10.1053/j. sempedsurg.2012.01.006. PMID: 22475119.

32. Breslow N, Olshan A, Beckwith JB, Green DM (1993). Epidemiology of Wilms tumor. Med Pediatr Oncol.;21(3):172-81.doi:10.1002/mpo.2950210305. PMID: 7680412.

33. Kaste SC, Dome JS, Babyn PS, et al. (2008). Wilmstumour: prognostic factors, staging, therapy and lateeffects. Pediatr Radiol. ;38(1):2-17. doi: 10.1007/s00247-007-0687-7. Epub 2007 Nov 17. PMID: 18026723.

34. Davidson A, Hartley P, Desai F, et al. (2006). Wilms tumour experience in a South African centre. Pediatr Blood Cancer.; 46(4):465-71. doi: 10.1002/pbc.20388. PMID: 16342063.

35. Elayadi M, Magdy S, Khalil E, Zekri W (2020). Management and outcome of pediatric metastatic Wilms' tumor at the National Cancer Institute, Egypt. J Egypt Natl Canc Inst.;32(1):19. doi: 10.1186/s43046-020-00031-7. PMID;32372204.

36. Osuoji RI, Williams OM, Ajai OT, et al. (2011). Wilms' tumor: Experience in a developing tertiary centre in Nigeria. East and Central African Journal of Surgery; 16(3): 51-57. https://tinyurl.

37. Ekenze SO, Agugua-Obianyo NE, Odetunde OA (2006). The challenge of nephroblastoma in a developing country. Ann Oncol.;17(10):1598-600. doi: 10.1093/annonc/mdl167. Epub 2006 Jul 27.PMID: 16873431.

38. Woldeab WE, Nyongole OV, Frank B (2016). Wilms' tumor: Presentation and outcome at Kilimanjaro Christain Medical Center. JMR; 2(4): 114-117.

39. Ledlie EM, Mynors LS, Draper GJ, Gorbach PD (1970). Natural history and treatment of Wilms's tumour: an analysis of 335 cases occurring in England and Wales 1962-6. Br Med J;4(5729):195-200. doi: 10.1136/ bmj.4.5729.195. PMID: 4319612;PMCID: PMC1819756.

40. Wilde JC, Lameris W, van Hasselt EH, et al. (2010).Challenges and outcome of Wilms' tumour management in a resourceconstrained setting. Afr J Paediatr Surg;7(3):159-62. doi: 10.4103/0189-6725.70416. PMID: 2085902.