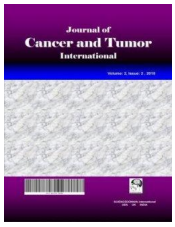

Journal of Cancer and Tumor International

9(2): 1-9, 2019; Article no.JCTI.48114
ISSN: 2454-7360

Changing Histopathological Pattern of Paediatric Malignant Tumours Seen at the Jos University Teaching Hospital, North-Central, Nigeria

Daniel Yakubu[1*], Innocent Emmanuel[2], Jagshak Barnabas Mandong[3] and Mandong Barnabas Mafala[2]

[1]Department of Anatomical Pathology and Forensic Medicine, Kaduna State University, Kaduna, Nigeria.
[2]Department of Histopathology, Jos University Teaching Hospital, Jos, Nigeria.
[3]Federal Medical Center Keffi, Nigeria.

Authors' contributions

This work was carried out in collaboration among all authors. Author DY designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors IE and JBM acquired the data and managed the analyses of the study. Author IE wrote the final draft. Authors DY, IE and MBM managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JCTI/2019/v9i230103
Editor(s):
(1) Dr. Bing Yan, Department of Oncology, Hainan Branch of PLA General Hospital, China.
Reviewers:
(1) Manas Bajpai, NIMS Dental College, India.
(2) Kritika Subramanian, St. George's University, Grenada.
(3) Amal Ahmed Fouad Halim, Mansoura University, Egypt.
Complete Peer review History: http://www.sdiarticle3.com/review-history/48114

Original Research Article

Received 20 February 2019
Accepted 06 May 2019
Published 31 May 2019

ABSTRACT

Background: Childhood cancer is attracting public health attention in Sub-Saharan Africa because of its' increasing contribution to morbidity and mortality, and the changing pattern in relative frequency and diagnostic challenges in resources poor settings. The objective of the study was to determine the pattern of malignant childhood tumours in Jos, North-central Nigeria.
Materials and Methods: Records of childhood malignancies diagnosed over a 10 year period was obtained from the hospital cancer registry. Archival paraffin embedded, formalin fixed tissue blocks were retrieved and fresh sections cut and stained with Haematoxylin and Eosin. The slides were

**Corresponding author: Email: danyakubu40@yahoo.com;*

reviewed and the histopathological pattern, age, sex and anatomical site of distribution of the tumours were analyzed.

Results: There were 210 cases of childhood malignancies during the period of the study. The male: female ratio was 1.5:1. Mesenchymal tumours predominated (66%), followed by epithelial tumours (32%) and germ cell tumors which accounted for 2% of cases. Soft tissue sarcomas, lymphomas, nephroblastoma and retinoblastoma were the four most common tumours. Together they accounted for 88% of all cases. Soft tissue sarcoma was the most common tumour group with 77 cases (37%). Rhabdomyosarcoma was the most common of them accounting for 88% of the soft tissue sarcomas. The second most common group of tumours was lymphoma 52(25%) cases: out of which Burkitt's lymphoma accounted for 64%, non Burkitts non Hodkins lymphomas 31% while Hodgkins Lymphoma had 6%. Retinoblastoma and nephroblastoma occurred among the very young children while STS and lymphomas predominated in the older children.

Conclusion: There is a change in the histopathological pattern of childhood solid malignancies in our environment. Sarcomas are diagnosed more often, a departure from the past where lymphomas were commoner. However Burkitt's lymphoma is still an important and common childhood cancer.

Keywords: Changing; childhood tumors; lymphoma; Jos.

1. INTRODUCTION

Cancer in childhood constitutes a unique challenge. In developed countries, cancer is said to kill more children than any other disease, only second to accidental death [1]. It accounted for 9% of all natural deaths [2].

Tumours occurring in children have continued to attract public health attention in developing countries due to progressive decline in diseases resulting from infection and malnutrition [3-8].

Paediatric solid neoplasm differ in type, incidence, clinical features, biological behavior, diagnosis, and in response to treatment as compared to those found in adults [9]. Most paediatric neoplasms are mesenchymal in origin while majority of adults neoplasms are epithelial in histogenesis. Tumours with peak incidence in childhood includes: Rhabdomyosarcoma (RMS), Burkitt's Lymphoma, Nephroblastoma (Wilms tumour), Neuroblastoma, Retinoblastoma, Ewing's sarcoma/primitive neuroectodermal tumour (EWS/PNET), Medulloblastoma and Hepatoblastoma. Most of these are aggressive tumours but largely amenable to treatment.

Recent literature in our environment seems to suggest a changing pattern in the relative frequency of the various childhood malignant tumours [6,8,10-17]. Reports from medical centers in Nigeria have demonstrated the changing pattern in the relative frequencies of childhood malignancies with decline in the incidence of Burkitt's lymphoma [18,19,20].

In childhood, cancer treatment including chemotherapy, radiation therapy and surgery adds significantly to morbidity and cancer related mortality. Also the risk of second malignant neoplasm (SMN) is high among patients treated with radiotherapy and chemotherapy emphasizing the need for accurate diagnosis [21, 22,23].

Some commonly reported/researched childhood tumours include: Nephroblastomas, Rhabdomyosarcomas, Kaposi Sarcoma, Burkitt's lymphoma, Neuroblastoma, Ewing's sarcoma/ PNET, and osteosarcoma [24-59].

This study was undertaken to determine the histopathological pattern, age, sex and the anatomical distribution of childhood solid malignancies at our center, to add to, and compare and contrast with exiting literature.

2. MATERIALS AND METHODS

The study was a 10 year hospital based retrospective study employing records from the cancer registry and archival slides and tissue blocks used for previous diagnosis of malignant solid tumours between January 2006 to December 2015 in the Histopathology Department and Cancer registry of the Jos university teaching hospital (JUTH). The Jos University Hospital is a tertiary hospital, a pioneer tertiary/teaching Hospital in North Central Nigeria, and a major referral center for all hospitals in this locality. It attends to patients from virtually all states in the North-Central states of Nigeria.

All cases with solid tumors falling within the age bracket 15 years and below were included in the study. All cases with incomplete or missing bio-data (age and sex) and anatomical location were excluded.

For each case of childhood tumour, the histological diagnosis, age, sex, and site was obtained. The tumors were classified according to International Classification of Childhood Cancers (ICCC).

The data generated was analyzed using EPI info® 3.3.2 statistical software and are presented in frequency tables.

As a hospital based study, it is limited by the fact that not all cases with the disease would have sought care from the Hospital (Jos University Teaching Hospital) and as such more cases in our locality might not have been captured. Also as a retrospective study, incomplete and missing information led to the exclusion of some cases.

3. RESULTS

A total of 1,930 malignancies were seen within the study period of which 210 were seen in children accounting for 10.9% of all malignancies seen. One hundred and twenty six (60%) were males and 84 (40%) were females giving a male to female ratio of 1.5:1.

Mesenchymal tumours predominated, accounting for 139(66%) cases. Epithelial tumours and germ cell tumours accounted for 68(32%) and 4 (2%) cases respectively. The four most common tumours included STS, lymphomas, nephroblastoma, and retinoblastoma, together accounting for 88% of all malignancies seen (see Table 2). Soft tissues sarcomas (STS) were the most common malignancies diagnosed with 78 cases accounting for 37% of all malignancies seen, out of which RMS accounted for 68(88%) cases of the STS. Lymphomas were the second largest group with 52(25%) cases, of the malignancies seen out of which Burkitt's lymphoma was the single most common lymphoma with 33(64%) cases. Nephroblastoma and Retinoblastoma, were the third and fourth most common tumours accounting for 29(14%) cases and 26(12%) cases respectively.

The general male to female ratio was 1.5:1 (see Table 1). Most tumours seen show male predilection. Tumours with high male to female ratio were RMS 1.8:1, retinoblastoma 1.6:1, neuroblastoma 2:1, Hodgkin's lymphoma 2:1, NHL 1.2:1 and Nephroblastoma 1.1:1.

All ages were represented from 3 months to 15 years. The mean age was 8.3 year, median age was 8 year, the modal age was 15 years (see Table 2). Generally the older children in age group 12 – 15 years had the highest number of tumours (66 cases, 32%), followed by the 4 – 7years age group (51 cases, 24%). Fourty nine (23%) cases of the tumours occurred within the 8-11 years age group while the age group 0-3 years had the least 4(21%) cases.

4. DISCUSSION

This study shows that childhood solid malignancies account for significant proportion of malignancies generally. In this study, it accounted for 10.9% of all solid malignancies diagnosed within the period of study. This calls for an increasing attention in terms of allocation of resources and research towards childhood cancers.

The study also shows the predominance of mesenchymal over epithelial tumors which is in agreement with earlier reports in both local and western literatures [2,5-7]. In this study mesenchymal malignancies accounted for 66%, epithelial tumors 32%, while germ cell tumors accounted for 2%. The finding in this study concurred with Samaila et al., in Zaria where 60% of childhood tumours were mesenchymal, while 39% were epithelial and germ cell tumors combined [6]. Mohammed and Aliyu in Zaria also noted that germ cell tumors were very uncommon in the pediatric population [8].

The study showed that the most common malignancies diagnosed in children were STS particularly RMS accounting for 37% compared to lymphomas which accounted for 25%. RMS singly account for 32% of all tumors while Burkitt's lymphoma accounted for 15% of cases.

Previous literatures have shown that Burkitt's lymphoma was the most common childhood malignancy in Sub-Sahara Africa [6,8,11-19,57]. Tanko et al. in Jos however identified RMS as the most common malignant solid tumor [5]. Alhough it was a 5 year study, this current study, a 10 year wider review, has amplified the declining relative incidence of Burkitt's lymphoma. Despite a recent publication from Jos by Okpe et al. [58], which identified Burkitt's lymphoma as still the most common childhood malignancy, it was a clinical based prospective

study and may not have captured all data from the paediatric surgery and the orthopaedic surgery units of the hospital. Data from the hospital cancer registry and records of the histopathology laboratory as in this study is all encompassing and more likely to capture all diagnosis of childhood malignancies.

It may actually not be surprising that Burkittt's lymphoma is on the decline because of efforts been made in African towards the eradication of malaria which play a role in its pathogenesis [60,61,62]. It is possible that the decline in Bukitt's lymphoma is a reflection of the gains been achieved [60,61,62].

Table 1. Relative frequency and sex distribution of tumours based on the International classification of childhood cancers (ICCC)

Histological type of tumour	N	Male	Female	M/F	R. Freq %
Lymphoma (52)					
Hodgkin's	3	2	1	2:1	1.4
Non-Hodgkin's	16	11	5		8
Burkitt's	33	18	15	1.2:1	16
Others non-specified	0	0	0	0	0
CNS, Intracranial, Intraspinal Neoplasms	0	0	0	0	0
Neuroblastoma	3	2	1	2:1	1.4
Retinoblastoma	26	16	10	1.6:1	12
Nephroblastoma	29	15	14	1.1:1	14
Bone tumour					
Osteosarcoma	8	4	4	1:1	4
Chrondrosarcoma	0	0	0	0	0
Ewing's Sarcoma	0	0	0	0	0
Soft tissue (78)					
Rhabdomyosarcoma	68	44	24	1.8:1	32
Fibrosarcoma	2	2	0	-	1
Kaposi sarcoma	6	3	3	1:1	3
Others	1	0	1	-	0.5
Germ cell/gonadal					
Sacrococcygeal Tumour	4	2	2	1:1	2
Testicular	0	0	0	0	0
Ovarian	0	0	0	0	0
Carcinomas					
Nasopharyngeal	0	0	0	0	0
Hepatoblastoma	1	1	0	_	0.5
Colorectal carcinoma	1	0	1	_	0.5
Extraocular Tumour	5	3	1	3:2	2.4
Thyroid Tumour	0	0	0	0	0
Salivary Gland Tumour	0	0	0	0	0
Genito-urinary Tumour	0	0	0	0	0
Endometrial Tumour	0	0	0	0	0
Oral Tumour	0	0	0	0	0
Breast	0	0	0	0	0
Unspecified	0	0	0	0	0
Other malignant tumours					
Specified (MPNST)	1	1	0	-	0.5
Unspecified	3	1	2	1:2	1.4
Total	210	126	84	1.5:1	100

Table 2. Age at diagnosis of childhood malignant tumours in Jos

Age group	STS	Lymphoma	Nephroblastoma	Retinoblastoma	Neuroblastoma	Osteosarcoma	GCT	Others	Total	%	Cum. %
0-3	10 [23%] (13%)	1 [2%] (2%)	8 [18%] (25%)	19 [43] (73)	3 [7%] (100%)	-	3 [7%] (75%)	-	44	21	21
4-7	19 [37%] (25%)	17 [33%] (32%)	10 [20%] (34%)	3 [6] (12½)	-	-	-	2 [4%\] (19%)	51	24	45
8-11	15 [31%] (19%)	16 [33%] (31%)	7[14%] (24%)	3 [6] (12½)	-	2 [4%] (25%)	1 [2%] (25%)	5 [10] (45%)	49	23	68
12-15	33 [50%] (43%)	18 [27%] (35%)	4 [6%] (14%)	1 [2%] ([4%)	-	6 [9%] (75%)	-	4 [6] (36%)	66	32	100
Total	77	52	29	26	3	8	4	11	210		100
% of Tumour	37%	25%	14%	12%	1%	4%	2%	5%		100	
Cum. %	37%	62%	76%	88%	89%	93%	95%	100%			100

STS – Soft Tissue Sarcoma; GCT – Germ Cell Tumours; [ ] – percentage of tumour in the age group; ( ) – Percentage of a tumour in a tumour group

More so Ocheni et al. [18] and Ojesina et al. [19] in eastern and western Nigeria respectively have all demonstrated similar decline in Burktt's lymphoma relative to other malignancies. It is worthy to note that both holoendemic malaria and endemic Burkitt's Lymphoma show highest incidence rates in areas abutting the equatorial (+/−10°) areas of Africa, a location designated the "lymphoma belt" or "malaria belt" [63]. This study was undertaken in this geographical area (Jos, Nigeria).

The predominance of embryonal and alveolar RMS and the distribution pattern in this study is similar to a study by Mandong et al. [46] in Jos which recorded 54% embryonal, 22% alveolar RMS, and 14% pleomorphic RMS in children which is a little higher than the 2% recorded in this study. Pleomorphic sarcomas are generally uncommon in children.

The relative lower frequency of other tumours-retinoblastoma and nephroblastoma are quite in keeping with most local and international literatures [2,6,8,11-19].

The obvious absence of central nervous system tumours is probably due to the fact that intra-cranial biopsy was low due to lack of neurosurgical personnel which were not readily available in our locality (region of the study). Therefore we might have not captured the true incidence of childhood CNS tumors in this study. More so Autopsy rate has been very low in our center. Gyasi et al. recorded 10% of CNS tumors out of 252 malignancies in an autopsy based study in Ghana West Africa [7]. CNS tumor is reported as the most common non-haematological malignancies among western children [2].

Also noted is the low frequency of neuroblastoma, the most common extra-cranial solid tumours of childhood in western society and absence of Ewing's sarcoma, the second most common sarcoma in childhood among western children [2]. Only 3 cases of neuroblastoma was recorded, all occurring within the first 3years of life. Some local studies have demonstrated similarly that this primitive neuroepithelial tumours are uncommon among black children [6, 24,28,55]. Osteosarcoma is the only non Burkitt's malignant bone tumour seen in this study which has 8cases. This is consistent with findings in Africa were osteosarcoma is reported to be the most common primary malignant bone tumour in children and adolescents in both African and western societies [21,25,26,56]. Only 1 case of hepatoblastoma was seen in this study which is as rare as the 1 case seen by Pindiga et al. in Maiduguri [57].

All the 8 cases of Kaposi sarcoma seen were HIV sero-positive similar to studies by Samaila and Rafindadi in Zaria.77 [6,32]. Three (3) cases were also recorded by Pindiga et al., in Maiduguri [57]. This shows the close association between childhood Kaposi sarcoma and immune-suppression.

The general male: female ratio of 1.5:1 is a little higher than the 1.2:1 reported by researchers alluded earlier, Samaila in Zaria and Gyasi et al. in Ghana and 1.3:1 by Tanko et al. in Jos central Nigeria. This suggests the preponderance of childhood tumor in female gender in our environment.

The age incidence of the tumours shows that retinoblastoma and embryonal RMS, and nephroblastoma were the predominant tumours in the very young, while lymphomas and alveolar RMS are diseases of the older child. The early onset of retinoblastoma and some sarcomas suggested that inherited genetic syndromes of cancer susceptibility may play a significant role in the pathogenesis of childhood malignancies in our environment and may require further research to determine their pathogenic role with possibility of genetic screening of at risk family members in the future. Nephroblastoma, the most common intra-abdominal malignancy of childhood has been shown to present in the very young in a study by Uba et al., al in Jos (central Nigeria) [64]. The rarity of pleomorphic sarcomas in children in this study is in agreement with other studies [65].

5. CONCLUSION

There is a change in the histopathological pattern of childhood solid malignancies in our environment. Sarcomas are diagnosed more often, a departure from the past where lymphomas were more common. The extensive program in rolling back malaria in our opinion is contributory to this trend. However Burkitt's lymphoma is still an important and common childhood cancer.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The research was given due ethical consideration, ethical review and approval was granted before the commencement of the research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Peter GJ, Peter EC, Harvey EB. Malignant disease in childhood, causes statistics and survival: In Tumour of Infancy and Childhood: Staff of the Royal children hosp. Melbourne. 1975;1.
2. Anirban Maitra: Diseases of infancy and childhood. In Kumar, Abbas and Fausto (Ed). Robins and Cotran: Pathologic basis of Disease, 8th Ed. India. Elsevier – sounders. 2010;473-481.
3. Kanavos P. The rizing burden of cancer in the developing world. Ann Oncol. 2006;17 (Suppl. 8):Viii15-Viii23.
4. International Union against cancer. The my child matters initiative (press release). Geneva. UICC; 2005.
5. Tanko NM, Echejoh GO, Manasseh WA, Mandong MB, Uba AF. Paediatric solid tumours in Nigerian children: a changing pattern? : AFr J. Paediatricsurg. 2009; 6:7-10.
6. Samaila MO. Malignant tumours of childhood in Zaria. Afr J Paediatric Surg. 2009;6:19-23.
7. Gyasi R, Tettey Y. Childhood deaths from malignant neoplasms in Accra, Ghana. Med J. 2009;41(2).
8. Mohamed A, Aliyu HO. Childhood cancers in a referral hospital in Northern Nigeria. Indian J Med Paediatroncol. 2009;30(3)95-98.
9. Hart IJ. Tumours of the newborn and infants: Armed forces royal college of pathology. 1-21.
10. Yaris N, Mandiracioglu A, Buyukpamukcu M. Childhood cancers in developing countries. Pediatric Hematoloncol. 2004; 21:237-253.
11. Akang EE. Tumours of childhood in Ibadan, Nigeria (1973 - 1990). Pediatri Pathology Lab Med. 1996;16:791-800.
12. Ekanem IA, Asindi AA, Ekwere PD, et al. Malignant childhood tumours in Calabar, Nigeria, Afr. Med Sci. 1992;21:63-69.
13. Ocheni S, Okafor CO, Emodi IJ, et al. Spectrum of childhood malignancies in Enugu, Nigeria (1999- 2004). Afr. J, Med Sci. 2005;34:371-375.
14. Seleye- FD, Akani NA. Solid malignancies in children and adolescents: Experience of the University of Port Harcourt Teaching Hospital. Nig J Paediatri. 2004;31:43-47.
15. Onwasigwe CN, Aniebu PN, Ndu AC. Spectrum of paediatric malignancies in Eastern Nigeria (1989- 1998). West African J Med. 2002;21:31-33.
16. Mandong BM, Angyo IA, Zoakah AI. Paediatric solid malignant tumours in JUTH, Jos (Hospital based histopathology study). Nig J Med. 2000;9:52-55.
17. Ayodeji OJ, Folushade AA, Adewale AM et al. Pattern of childhood malignant tumours in a teaching hospital in South Western Nigeria MJA. 2009;190:12-14.
18. Ocheni S, Bioha FI, Ibegbulan OG, Emodi IJ, Ikefuna AN: Review, changing pattern of childhood malignancies in Eastern Nigeria: West Afr J Med. 2008;27(1):3-6.
19. Ojesina AL, Akang EE, Ojemakinde KO: Decline in the frequency of Burkitt's lymphoma relative to other childhood Malignancies in Ibadan, Nigeria: Ann Trop Paediatric. 2002;22(2):159-63.
20. Thomas J.O, Adesunwa AO. Immunocytochemistry in the diagnosis of small blue cell tumours of childhood. WAJM. 2006;25(3).
21. Atsushi O, Masahito H, Masami H, Munenori W, EIJI I. Secondary osteosarcoma arising after treatment for childhood hematologic malignancies. Upsala Journal of Medical Science Japan. 2009;114(4):249-255.
22. Joshua DS, Jennifer W. Ewing's Sarcoma and second malignancies: Hindawi publishing Corporation USA; 2011. Article ID 736841.
23. Robert G, Cynthia B, Rajaram N, Tianni Z, Zhengjia C, Neyssa M, Debra F, Joseph N, Paul C, Smita B. Second solid malignancies among childhood, adolescent and young adults diagnosed with malignant bone tumours after 1976; Follow up a children's oncology group Cohort: NIH, USA, Cancer. 2008;113(9):2597-2604.
24. Patient education office, University of Texas MD Anderson cancer centre; Ewing's family of tumours for the paediatric patient.

25. Omololu AB, Ogunbiyi JO, Ogunlade SO, Alonge TO, Adebisi A, Akang EE. Primary malignant bone tumours in a tropical African University Teaching Hospital. WAJM. 2002;21(4).
26. Andrew E, Rosenberg MD. Joints and soft tissue tumours: In Kumar, Abbas Fausto (Eds). Robbins and Cotran Pathologic basis of diseases, 8th ED India Elsevier – Saunders. 2010-1232.
27. Enzinger and Weiss's. Introduction and epidemiology of soft tissue tumours. In soft tissue tumours CHP. 1, 4th ED. 1-2.
28. Mohammed A, Isa HA. Pattern of primary bone tumours and tumour like lesions in Zaria Northern Nigeria, an overview of 127 cases. West Afr J Med. 2007;26:37-41.
29. Simona O, Amy AL, Bridget Charbonneau MS. Trends in childhood rhabdomyosarcoma, incidence and survival in the US (1978–2005). NIH Cancer. 2009;118(18):4218. DOI: 10.1002/encr, 24465.
30. Sheri LS, Stephen XS, Cheryl MC. Pediatric Non-rhabdomyosarcoma soft Tissue Sarcoma: The Oncologist. 2008; 13:668-678.
31. Karnak I, Cifta AO, Senocak ME, Buyukpamukcu N. Colorectal carcinoma in children. J. Paediatrisurg. 1999;34:1499–1504.
32. Rafindadi AH. Childhood vascular Tumours in Zaria, Nigeria: 10 years retrospective study (1984 – 1995): West Afr J Med; 2000.
33. Thomas PS, Vinay K Neoplasia. In Kumar, Abbas and Fausto (Ed). Robins and Cotran: Pathologic basis of Disease, 8th Ed. India. Elsevier–Sounders. 2010;273-275.
34. Magrath I, Jain V, Bharia K. Epstein – Barr Virus and Burkitt's lymphoma. Semin Cancer Biol. 1992;3:285–295.
35. Whittle HC, Brown J, Marsh K, et al. T cell control of Epstein – Barr virus infected B cell is lost during *P. falciparum* malaria. Nature. 1984;312:449–450.
36. MA Durosinmi. Handbook of Haemato-oncology chemotherapy: Amkra and Allied Services, Second ED. 32–42.
37. Amusa YB, Adediran IA, Akanpelu Vo, et al. Burkitt's lymphoma of the head and Neck region in a Nigeria Tertiary Hospital. W. Alr J Med. 2005;24(2):139–422.
38. Adeyemi BF, Kolade BM, Ogun GO, Akang EE. Paediatric head and neck malignancies in Ibadan, Nigeria: HNO 2009;57(11)1209-1219:701617.
39. Bukola FA, Lola VA, Bamidele MK, Effiong EU, Akang EE, Jonathan OL. Head and Neck cancer, a clinico – pathological study in a tertiary care centre. Pediatrhematol. Oncol. 24(7):537–5, 17786789.
40. Martin DO, Kisher B, Robert JB, Sam MN. Incidence and geographic distribution of endemic Burkitt's lymphoma in Northern Uganda. Int J Cancer. 2008:18767045.
41. Martin G, Florian GD, Wolfgang AW, Jorg MH, Oliver D. Fibrosarcoma of the Childhood mandible, case report. Head and Face Medicine. 2008;4(21).
42. Soares AB, Lins LHS, Mazedo AP, Neto JSP, Vargas PA. Fibrosarcoma originating in the mandible. Med Oral Patol Oral Cirbucal. 2006;11(3):E243-246.
43. Leitner C, Hoffmann J, Krober S, Reinert S. low – grade malignant fibrosarcoma of the dental follicle of an unerupted third molar without clinical evidence of any follicular lesion. J Cranio–Maxillofacsurg. 2007;35:48–51.
44. Pereira CM, Jorge JJr, DI Hipolito O Jr., Kowalski LP, Lopes MA. Primary intraosseousfibrosarcoma of the jaw. Int J Oral Maxillofac Surg. 2005;34:579-81.
45. Orhan K, Orhan AL, 0Z U, Pekiner FN, Delibasi C. Misdiagnosed fibrosarcoma of the mandible mimicking temporomandibular disorder. A rare condition. Oral Surg Oral Med Oral Pathol Oral Radiolendod. 2007;104:26-9.
46. Mandong BM, Manasseh AN, Tanko AN Silas OA, Dauda AM. Childhood rhabdomyosarcoma: Areview of 35 cases. Nig J. Med. 2011;20(4):466-469.
47. Malogolowkin MH, Ortega JA. Rhabdomyosarcoma in children. Paediatric Ann. 1988;17:251–265.
48. Arnold HH, Winter B: Muscle differentiation: More to the network of myogenic regulators. Curr Point Genet Deu. 1998;8:539–544.
49. Arya MJ. Pure testicular rhabdomyosarcoma: Archive Iranian medicine. 1999;2(3)235.
50. Terrier–Lacombe MJ, Martinez–Madrigal F, Porta W, Rahal J, Droz JP. Embryonal Rhabdomyosarcoma arising in a mature teratoma of the testis: A case report. J Urol. 1990;143(6):1232–4.
51. Alexanda F. Pure testicular rhabdomyosarcoma. BR J Cancer. 2008; 22:495–501.

52. Kumar Pvn, Khezri AA. Testicular rhabdomyosarcoma. Br J Urology. 1987; 59:282.
53. Parham DM, Barr FG. Embryonal and alveolar rhabdomysarcoma. In W.H.O Classification, pathology and genetics of soft tissues and bone tumours. Edited by Fletcher DM, Unni KK, Mertens F: ARC press, Lyon, France. 2002;146-152.
54. Susan L Cohn. Diagnosis and classification of small round cell Tumours of childhood. AM J Pathol. 1999;155(1): 11–15.
55. Saral SD, Mirmal AJ; Pathology of Ewing's Sarcoma/PNET: Current opinion and Emerging concepts. India J Orthop. 2010;44(4):363–368.
56. Mitul P, Ram S, Raui K, Anand KM, Kusheji SS, Amansit B: Peripheral primitive neuroectodermaltumour of the chest wall in childhood: Clinical–pathological significance, management and literature review. Chang Gung Met J. Nol. 2011; 32.
57. Pindiga HU, Ahmed GS, Nghada HI. Childhood malignancies in Maiduguri North eastern Nigeria. Borno Med J. 2004;1(2): 17–20.
58. Okpe ES, ABok II, Ocheke IE, Okolo SN. Pattern of childhood malignancies in Jos, north central. Nig J Med Trop. 2011;13(2): 109–114.
59. Bajpai M, Pardhe N, Chandolia B, Arora M. Osteogenic sarcoma of mandible. J Coll Physician Surg Pak. 2017;27:26-27.
60. Geser A, Brubaker G, Draper CC. Effect of a malaria suppression program on the incidence of African Burkitt's lymphoma. Am J Epidemiol. 1989;129(4):740-52.
61. Mutalima N, Molyneux E, Jaffe H, Kamiza S, Borgstein E, et al. Associations between Burkitt Lymphoma among Children in Malawi and Infection with HIV, EBV and Malaria: Results from a Case-Control Study. PLoS One. 2008;3(6):2505. DOI: 10.1371/journal.pone.0002505.
62. Brown BJ. A review of the literature on child-hood Burkitt lymphoma in Nigeria. Niger J Paed. 2016;43(1):1–7.
63. Orem J, Mbidde EK, Lambert B, de Sanjose S, Weiderpass E. Burkitt's lymphoma in Africa, a review of the epidemiology and etiology. Afr Health Sci. 2007;7(3):166–175. DOI: 10.5555/afhs.2007.7.3.166
64. Uba AF, Chirdan LB. Childhood Wilm's tumor: Prognostic factors in north central Nigeria. West Afr J Med. 2007;26:222–225.
65. Coffin CM, Allaggio R, Dehner P. Some general considerations about the clinical pathologic aspects of soft tissue tumors in children and adolescents. Paediatr Dev Pathol. 2012;15(1):11-25.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle3.com/review-history/48114