

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF RADIOLOGY**



**DIAGNOSTIC PATTERN WITH COMPUTERIZED TOMOGRAPHY OF
PEDIATRIC ABDOMINAL MASSES SEEN IN THE PEDIATRIC RADIOLOGY
UNIT AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA
UNIVERSITY, ADDIS ABABA, ETHIOPIA FROM MAY 1 2018 TO APRIL 30
2019**

**A SENIOR PAPER TO BE SUBMITTED TO RADIOLOGY DEPARTMENT,
COLLEGE OF HEALTH SCIENCES, ADDIS ABABA UNIVERSITY, IN
PREPARATION FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE POST GRADUATE STUDY IN RADIOLOGY.**

INVESTIGATOR: Dr. Kebron Atnaw (MD, Radiology Resident)

**ADVISORS: Dr. Daniel Zewdenh (Pediatric Radiologist)
Dr. Yocabel Gorfu (Pediatric Radiologist)**

**September, 2019
Addis Ababa, Ethiopia
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ABBREVIATIONS

AAU: Addis Ababa University

CT: Computerized Tomography

CECT: Contrast-enhanced computed tomography

MRI: Magnetic Resonance Imaging

TASH: Tikur Anbessa Specialized Hospital

Ca: Cancer

ABSTRACT

Background: Abdominal swelling is one of the common presentations in children for seeking medical attention. The causes are varied, including both benign and malignant entities, requiring very different sets of management. CT scan imaging plays a major role in the diagnosis and management of pediatric abdominal masses, local disease staging, identification of distant metastases, and monitoring response to therapy.

Objective: The aim of this study is to see the pattern of pediatric abdominal mass on CT scan findings in patients presented for abdominal CT scan to the Pediatric Imaging Unit, Department of Radiology, Tikur Anbessa Specialized Hospital.

Methods: A hospital-based cross-sectional study was conducted at Tikur Anbessa Specialized Hospital among pediatric patients from May 1 2018 to April 30 2019. The study population comprised all pediatric age group patients with abdominal swelling for whom abdominal CT examinations were done at the radiology department of TASH, pediatric radiology unit. Data were collected from May 1, 2018 to April 30, 2019 using structured data collection instrument which were analyzed using SPSS 25.0 software, then summarization and comparison of data were done.

Results: A total of 323 pediatric patients had abdominal CT done at the radiology unit and 176 (57%) patients had abdominal swelling fulfilling the inclusion criteria. Out of the included patients 97(53%) were male, 86 (47%) were female. The majority of patients were in the age group between 3 and 5 years of age 71(39%) followed by the age group of between years 1 and 2 accounting about 20% of the study population. 83.5% of the scanned patients had the origin of the mass identified while 29 patients (16.5%) had unidentified organ of mass origin. Of the identified organ of origin, the commonest was renal accounting for about 75 patients (42.6%) followed by adrenal and liver and biliary origin masses each accounting 9.7% and 9.1% of the reported cases respectively.

Of the identified organ of origin, 71 (40.4%) of patients had diagnosis of Wilm's. 39 patients (22.2%) had Wilm's tumor as the most likely diagnosis; 32 patients (18.2%) were known Wilm's tumor. 24 (13.7%) patients had diagnosis of neuroblastoma. 13 (7.4%) had neuroblastoma as most likely diagnosis; 11 (6.3%) were known neuroblastoma in the final impression of their reports. Lymphoma, both as a known diagnosis and most likely diagnosis, accounted for 22(12.5%) of the cases seen.

Conclusion: In this study, among pediatric patients for whom abdominal CT scan was done, Wilm's tumor was the commonest diagnosis followed by neuroblastoma and lymphoma. The commonest age group in which Wilm's tumor is seen is between the ages 3 and 5 years, which also accounted for the highest age group of the study population.

Key words: Wilm's tumor, Neuroblastoma, Lymphoma, CT scan

1. INTRODUCTION

1.1. BACKGROUND

Abnormal abdominal distension is one of the common clinical presentations in pediatric age group; early detection and intervention has a crucial role in the prognosis of the child. Diagnostic imaging plays an important role to diagnose before surgical intervention or medical therapy.

Abdominal CT is the main stay of imaging modality in pediatric patients with abdominal masses with suspected malignancy.

It is difficult to arrive at an accurate estimate of the relative incidence of abdominal tumors as compared with those in other locations.

It should be emphasized that all abdominal masses are not of neoplastic origin, and such lesions as hydronephrosis, appendiceal abscess, congenital duplication of the bowel, pancreatic pseudocyst, choledochal cyst, and even tuberculosis mesenteric adenitis may closely simulate large abdominal neoplasms.

Diagnostic imaging plays a major role in the diagnosis and management of pediatric abdominal masses, local disease staging, identification of distant metastases, and monitoring response to therapy.[1]

Although the differential diagnosis of a child with an abdominal mass is broad, among the most common diagnoses are Wilm's' tumor and neuroblastoma. All pediatric abdominal masses are included in this study. Introductory and literature review emphasis is on Wilm's and neuroblastoma given their highest prevalence in this age group.

Wilm's

Wilm's tumor is the most common cause of abdominal tumors in children in Sub-Saharan Africa [2]

Wilm's tumor is the most common abdominal malignancy of childhood and accounts for 87% of renal masses. Its peak incidence is at 3 to 4 years of age (80% occur in children <5 years), but it has been described in the fetus, neonate, teenager, and adult. Clinical presentation includes a palpable mass, abdominal pain, hematuria, and occasional hypertension (from tumor renin production).[3, 4]

Typically, the patient's age at presentation, clinical features, and imaging characteristics are often sufficient to presume a diagnosis. In some regions of the world, specific treatment protocols are initiated without obtaining a tissue diagnosis.[5]

Although the sensitivity of CT, that is to say the ability of CT to detect the presence of Wilm's', is 92% in the cohort study subject of D. Miniati et al, specificity is much lower at renal tumors in children 55%.[6]

Imaging may now even offer essential information regarding tumor entity; however, only some tumors can reliably be diagnosed purely based on imaging features, and histology remains irreplaceable in establishing the final diagnosis.[7]

Neuroblastoma

Neuroblastoma arises in the abdomen in two thirds of cases; of these, about two third of lesions occur in the adrenal, whereas the remainder may arise anywhere along the sympathetic nerve chains. [4, 8]

Most children with neuroblastoma present between 1 and 5 years of age, with a median age of almost 2 years. [4, 9]

Neuroblastomas typically present as palpable masses or with symptoms and signs related to local tumor invasion, metastatic disease, and the effects of hormone production or autoimmune response (opsoclonus-myoclonus syndrome).

Metastatic disease is seen in up to 70% of patients at presentation.

The most common sites include local and distant lymph nodes, bone, bone marrow, liver, and skin.

The diagnosis of neuroblastoma can be made by tissue biopsy, but a combination of positive bone marrow aspirate and increased urinary catecholamine metabolites (vanillyl mandelic acid and homovanillic acid) is sufficient to confirm the diagnosis. The urinary level of catecholamine metabolites is increased in almost 90% of cases of neuroblastoma. [8]

A characteristic imaging feature of neuroblastoma is the displacement of adjacent organs and the displacement or encasement of adjacent major vessels. Local spread may be to lymph nodes. Less frequently, direct invasion into the kidneys or liver may occur, and even less commonly, the tumor may extend into the spinal canal. [8]

1.2. STATEMENT OF THE PROBLEM

Abdominal distension is one of the common presentations in children. There are many causes including both benign and malignant entities. Early diagnosis and treatment has crucial impact on the prognosis of the child. CT is relevant and accurate in investigating children with abdominal mass.

In addition to characterization of the mass, the radiological staging in addition to its aid in diagnosis, helps plan the management option including surgical approach. Adequate knowledge of the patterns of abdominal masses on computed imaging in our set up assists the radiologist in reaching to the most accurate radiologic diagnosis adding to the quality of care of the patient.

1.3. RATIONALE OF THE STUDY

The aim of this study is to see the pattern of pediatric abdominal mass on CT scan findings so that the pattern can be identified and data can be utilized for further pathological correlational study subsequently.

1.4. OBJECTIVES

1.4.1. GENERAL OBJECTIVE

- To assess the CT scan patterns of abdominal masses among pediatric patients presented to pediatric imaging unit for Abdominal CT scan, Department of Radiology, Tikur Anbessa Specialized Hospital.

1.4.2. SPECIFIC OBJECTIVE

- To assess the frequency distribution of pediatric abdominal masses imaged with CT in the department
- To identify the commonest abdominal mass in the department
- To identify the less common abdominal mass in the department
- To assess the CT findings of Pediatric abdominal masses (Imaging Characteristics by their organ of origin)
- To assess age and sex distribution
- To create a platform for further pathological correlational study

2. LITERATURE REVIEW

A retrospective analysis of 77 patients below the age of 15 years with childhood malignancy admitted to the pediatric wards of Tikur Anbessa Hospital (TAH) in Addis Ababa during a 2 year period from January 2005 up to December 2006 is presented. Malignancies accounted for 3.1% of all admissions during this period. There were 55 (71.8%) males and 22(28.2%) females, with ages ranging from 3 months up to 12 years; 35 (44.9%) patients were in the age group 0-5years. The commonest malignancy was Wilm's tumor, which contributed for 19(24.7%) of cases. [10]

A retrospective study of 3 year period were carried out among all children aged below 15 years old admitted to the pediatric wards of Gondar University Hospital, Northwest Ethiopia. A total of 71 cancer cases were diagnosed and admitted to the pediatrics ward during the study period. More than two-third of the study subjects 50 (70.4 %) were males. The mean age of study subjects was 7 ± 4 year where majority 26 (36.6 %) of the study subjects were ≥ 10 years. Of all, 43 (60.6 %) were hematological malignancy followed by Wilm's tumor 13 (18.3 %), Neuroblastoma 5 (7 %), Rhabdomyosarcoma 3 (4.2 %), Brain tumor 3 (4.2 %), Hepatoblastoma 2 (2.8 %). [11]

Number of Newly diagnosed Wilm's Tumor in TASH; Addis Ababa, Ethiopia, from 2011 to 2013, as it is reported by V. Paintsil et al showed 40 cases in 2011, 28 cases in 2012, 52 cases in 2013, a total of 120 over the three years of the study period. [12]

On a prospective descriptive study conducted between January, 2011 to January 2012, carried out in a teaching hospital in Nigeria, all infants, 6-96 months of age, who were suspected to have Wilms' tumor were made to undergo CT scan examination as part of their management work-up. The majority of the tumors seen in the study crossed the midline and a few of them showed calcification. [2]

CT scan is relevant and accurate in investigating children with Wilms' tumor as it reveals concomitant lesions with involvement of the abdominal vessels and lymph nodes.[2]

In a study done before the advent of CT which included 67 cases of childhood abdominal tumors, all of which were large enough to be palpable or visible and palpable on initial examination. Of these 67 cases, 23 (34 percent) were Wilms' renal embryomas, 16 (24 percent) were abdominal neuroblastomas, and 28 (42 percent) were large tumors of various types, many of them quite unusual, which did not fall into either of the first two categories.[13]

3. METHODS AND MATERIALS

3.1. STUDY AREA

This study was conducted in the Pediatrics imaging Unit, department of radiology at Addis Ababa University, college of health sciences, Tikur Anbessa Comprehensive Specialized hospital, Addis Ababa, Ethiopia.

The hospital is a tertiary level referral and teaching hospital located at the capital of the country. The university is one of the centers of excellence in Ethiopia in undergraduate, post graduate and sub specialty programs in medical and health science.

The radiology department is one of the many departments in the institution which gives radiologic medical service and academic activities.

3.2. STUDY DESIGN

An institution based prospective study of all pediatric patients who came to the pediatric imaging unit, Department of Radiology, Tikur Anbessa Specialized Hospital for Abdominal CT scans. The study was conducted using one-year data from Radiology Department.

The department is equipped with high-tech radiologic machine including 128 slice Philips CT scanner and 64 Slice GE CT.

3.3. STUDY DURATION

Study was conducted from May1 2018 to April 30 2019 in all consecutive Pediatric age group patients who underwent Abdominal Computed Tomography Scan.

The Reports were analyzed as a main source of CT finding (data) which were reported/confirmed by two pediatric radiologists, pediatric imaging fellow and radiology residents on rotation in pediatric imaging unit.

3.4. DATA SOURCE

The radiology department Picture Archiving and Communication System (PACS); the reports and scans will be retrieved from the PACS.

3.5. STUDY POPULATION

Source population included patients in pediatrics age of 14 years and below presenting to Pediatric imaging unit in TASH for abdominal CT scan

Target population included patients fulfilling inclusion criteria and not excluded by the exclusion criteria and presenting to Pediatric imaging unit in the specified time frame.

That is, all patients who presented to the Pediatric imaging unit for abdominal CT scan from May 1 2018 to April 30 2019 were studied. All patients presenting in the defined time frame which passed the inclusion criteria were included and their data were collected from the Picture Archiving and Communication System (PACS) and were filled in the written questionnaire prepared and the data is analyzed.

3.6. INCLUSION AND EXCLUSION CRITERIA

3.6.1. INCLUSION CRITERIA

All selected patients who presented to the pediatric imaging unit for abdominal CT scan from May 1 2018 to April 30 2019.

3.6.2. EXCLUSION CRITERIA

Extrabdominal soft tissue tumors

Metastatic disease to intrabdominal organs

Abdominal wall tumors

Abdominal CT done for evaluation of any other known extra-abdominal primary

Post operative abdominal scans if their previous is not available

Patient treated before imaging if their previous is not available

Unreported abdominal scans

3.7. STUDY VARIABLES AND OPERATIONAL DEFINITION

3.7.1. INDEPENDENT VARIABLES

Age, Sex, clinical history, previous scans

3.7.2. DEPENDENT VARIABLES

Mass location, origin of mass, the size and characteristics of the mass.

3.8. MEASUREMENT AND DATA COLLECTION

There were a total of 323 pediatric patients who had abdominal computed tomography done at the radiology unit during the study period. All CT scans were done on 64 Slice GE CT scanner. The images were reported by the senior pediatric radiologist or fellow of pediatric radiology.

3.9. DATA ANALYSIS AND INTERPRETATION

The data was checked for clarity and completeness and it were entered and analyzed using SPSS version 25.0 software. Results are presented using tables and figures represented in percentages and measures of central tendency, then summarization and comparison of data was done.

3.10. ETHICAL CONSIDERATIONS

Data collection was done started after approval from the ethical review committee of the department of radiology at Addis Ababa University.

Data collection was done by the primary investigator.

Confidentiality of information was secured on the data retrieval form by omitting individual identifiers including name and addresses of patents.

Any information that was obtained during the study will be kept confidential.

3.11. QUALITY CONTROL AND DATA QUALITY ASSURANCE

Data was evaluated for completeness and patients with no report records were excluded from the study to keep the accuracy of the study.

3.12. DATA ANALYSIS AND INTERPRETATION

The data was checked for clarity and completeness and it was entered and analyzed using SPSS version 25.0 software. The descriptive statistics were calculated and results are presented using tables and figures represented in percentages and measures of central tendency, then summarization and comparison of data was done.

4. RESULTS AND DISCUSSION

4.1. RESULTS

There were a total of 323 patients for whom abdominal imaging was done among which 28 cases were not reported on the PACS. Among the reported cases abdominal mass was found in 176 (54.5%) of the cases excluding cases with only lymph node enlargements without solid or hollow organ mass lesions.

There were 176 patients who fulfilled the inclusion criteria and included in this study. Out of the included patients 93(52.8%) were male, 83 (47.2%) were female.

70(39.7 %) were aged between 3 to 5 years and about 20% were between years 1 and 2. The mean age was 4.76 yrs and with a median age of 4yrs. The least number of cases were seen in the first month age group (1%) (Table-1).

Among the 176 patients, 157 (89.2%) have abdominopelvic CTs done, 5.1% have chest, abdomen and pelvic scans and 2.3% have abdominal CT only.

175 (99.4%) of patients of the scanned patients were post contrast only studies; (pre contrast imaging is not done routinely for pediatric abdominal masses per the department protocol).

65 patients (40%) had previous or follow up imaging done in their course of follow ups and management.

Table 1 Demographic distribution and reported age pediatric patients with abdominal mass who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

| Age Category | Frequency | Percent | Sex Category | Frequency | Percent |
|----------------------|-----------|---------|---------------------|-----------|---------|
| 1st month | 1 | 0.6 | Male | 93 | 52.8 |
| 1 st year | 12 | 6.8 | Female | 83 | 47.2 |
| 1-2 yrs | 36 | 20.5 | Total | 176 | 100.0 |
| 3-5 yrs | 70 | 39.8 | | | |
| 6-8 yrs | 30 | 17.0 | | | |
| 9-12 yrs | 22 | 12.5 | | | |
| > 12 yrs | 5 | 2.8 | | | |
| Total | 176 | 100.0 | | | |

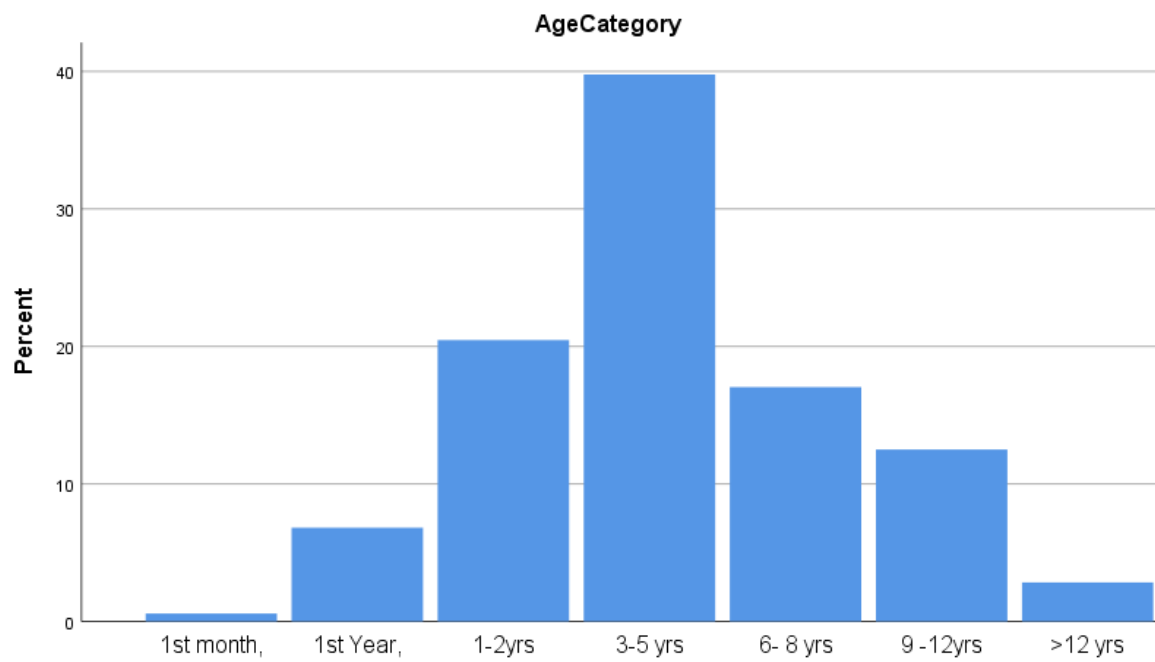


Figure 1 Age category of pediatric patients with abdominal mass who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

Of the total of 176 patients who fulfilled the inclusion criteria, 83.5% have the mass origin identified (reported), while 30 (16.5%) patients did not have clearly identified organ of origin reported.

Of the identified organ of origin, about 76 patients (42.6%) had renal origin being the most common followed by adrenal and liver and biliary origin masses each accounting 9.7% and 9.1% of the reported cases respectively [Table 2].

Table 2: Distribution of pediatric abdominal masses by their location pediatric patients with abdominal mass who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

| | Frequency | Percent |
|---|-----------|---------|
| Renal Tumors | 76 | 42.6 |
| Adrenal Tumors | 17 | 9.7 |
| Liver and Biliary tree tumors | 16 | 9.1 |
| Genitourinary tumors excluding renal Parenchymal mass | 13 | 7.4 |
| Gastric and intestinal tumors | 5 | 2.8 |
| Mesentery and peritoneal tumors | 5 | 2.8 |
| Leukemia, Lymphoma & reticuloendothelial tumors | 4 | 2.3 |
| Splenic masses | 2 | 1.1 |
| Clearly not identified | 29 | 17.0 |
| Multiple Location | 9 | 5.1 |
| Total | 176 | 100.0 |

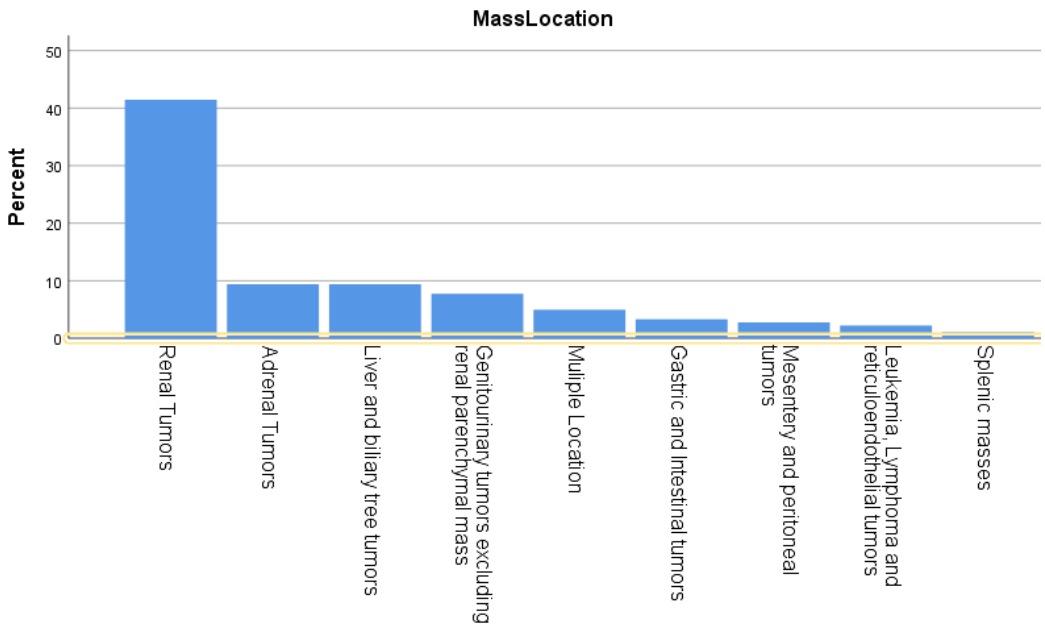


Figure 2: Bar chart of pediatric abdominal masses by their location who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

Of the identified organ of origin, 71(40.4%) of patients have the diagnosis of known Wilm’s or Wilm’s tumor as most likely and 24(13.7%) patients have diagnosis of known neuroblastoma or neuroblastoma as most likely on final impression of their reports. Lymphoma, both as known diagnosis and as most likely, accounted for 12.5% of the cases seen.

Wilm’s tumor was seen in highest frequency in the 3-5 yr age group 35 patients(49.3%) and it was least diagnosed in the age group of 9-12 years of age 2 patients(2%) and not seen in the 1st month and above 12 years of reported age groups.[Table-4]

Table 3: Frequencies and percentages of final impressions/conclusions reported among the 176 pediatric patients who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

| Conclusion | Frequency | Percent |
|------------------------------|------------------|----------------|
| Wilm's as most likely | 39 | 22.2 |
| Known Wilm's | 32 | 18.2 |
| Neuroblastoma as most likely | 13 | 7.4 |
| Lymphoma as most likely | 13 | 7.4 |
| Known Neuroblastoma | 11 | 6.3 |
| Known Lymphoma | 9 | 5.1 |
| Teratoma as most likely | 9 | 5.1 |
| RMS as most likely | 7 | 4.0 |
| Known RMS | 7 | 4.0 |
| Known Hepatoblastoma | 4 | 2.3 |

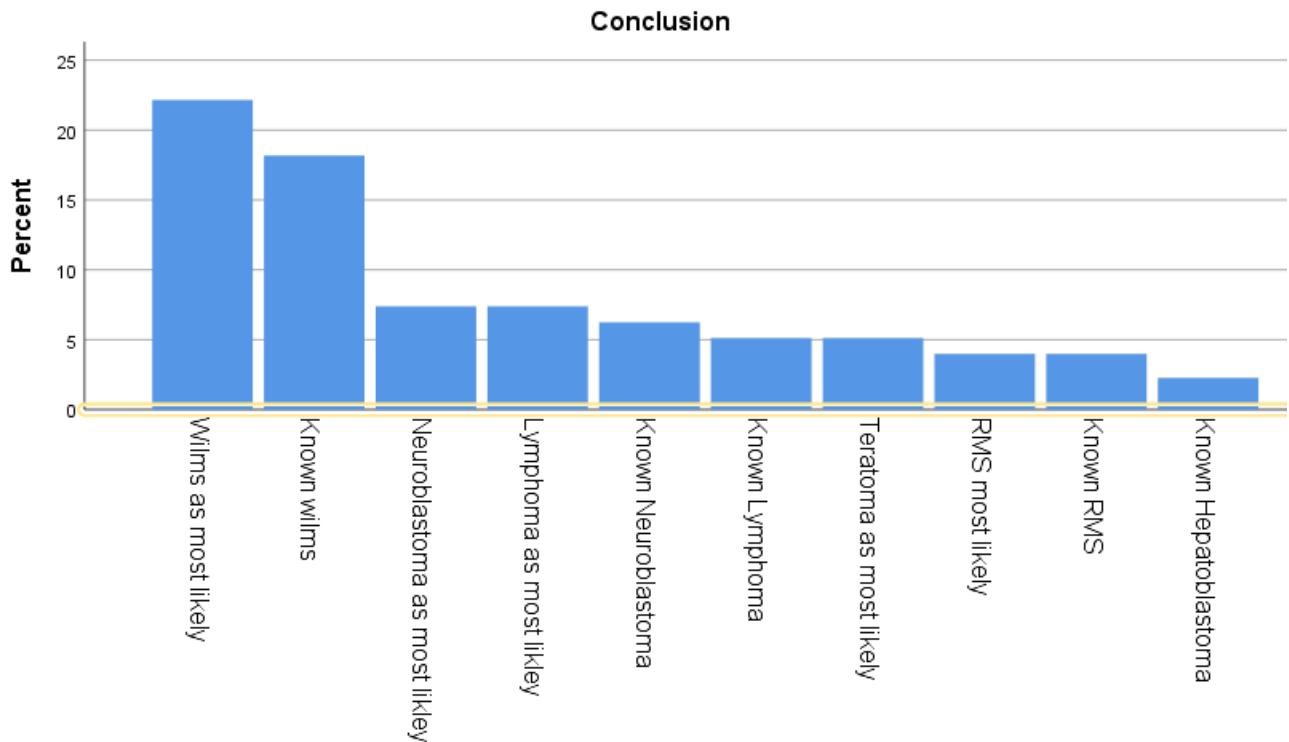


Figure 3: Percentages of final impressions/ conclusions of CT scan of pediatric abdominal masses who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

Table 4: Frequency of conclusions/ final impressions of the renal masses who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

| | Frequency | Percent |
|-------------------------------------|-----------|---------|
| Wilm's as most likely | 39 | 49.3 |
| Known Wilm's | 32 | 43.8 |
| Mesoblastic Nephroma as most likely | 2 | 2.7 |
| RCC as most likely | 1 | 1.4 |
| Multicystic Dysplastic kidney | 1 | 1.4 |
| Renal clear cell Ca as most likely | 1 | 1.4 |
| Total | 76 | 100.0 |

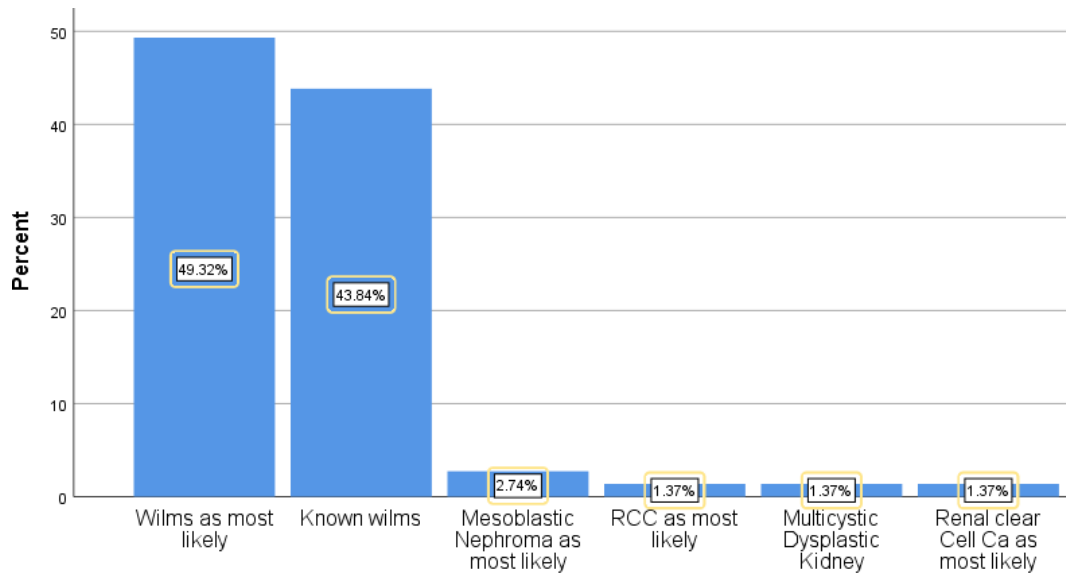


Figure 4 Frequency of conclusions/ final impressions of the renal masses who attended Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

Table 5: Distribution of the common conclusion/ final impression with their age category of the pediatric patients who were imaged for intra-abdominal mass at Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

| | Age Category | | | | | | | Total |
|-------------------------------|-----------------------|--------------------|-------|--------|--------|---------|--------|-------|
| | 1 st month | 1 st yr | 1-2yr | 3-5yrs | 6-8yrs | 9-12yrs | >12yrs | |
| Wilm's as most likely | 0 | 5 | 7 | 20 | 6 | 1 | 0 | 39 |
| Known Wilm's | 0 | 0 | 8 | 15 | 8 | 1 | 0 | 32 |
| Neuroblastoma as most likely | 0 | 0 | 6 | 4 | 3 | 0 | 0 | 13 |
| Known Neuroblastoma | 0 | 0 | 6 | 4 | 1 | 0 | 0 | 11 |
| Lymphoma as most likely | 0 | 0 | 0 | 6 | 4 | 3 | 0 | 13 |
| Known Lymphoma | 0 | 0 | 0 | 4 | 2 | 3 | 0 | 9 |
| RMS as most likely | 0 | 0 | 3 | 3 | 1 | 0 | 0 | 7 |
| Known RMS | 0 | 0 | 1 | 3 | 0 | 2 | 1 | 7 |
| Hepatoblastoma as most likely | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| Known Hepatoblastoma | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 4 |
| Teratoma as most likely | 0 | 3 | 1 | 1 | 1 | 2 | 1 | 9 |

Uncommon pediatric masses reported account for only 39 cases (26.7%) and are, tuberculosis, organomegally, RCC, duplication cyst, mesenteric cysts, mesoblastic nephroma, ovarian teratoma, caroli disease, cirrhotic liver with regenerative nodules, ovarian tumor, pseudocyst, mesenteric cysts, hydronephrosis, biliary hamartoma, multicystic dysplastic kidney, cecal mass likely benign, renal clear cell ca, mesenteric mass, known dysgerminoma, Hepatocellular carcinoma-HCC, known hemangioendothelioma, and choledochal cyst each accounting for 1 to 2 patients (1.7%). [Table-6]

Table 6: Frequency and percentages of uncommon conclusions/final impressions reported in pediatric patients for whom abdominal CT was done at Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019.

| | Frequency | Percent |
|---|-----------|---------|
| Tuberculosis as most likely | 2 | 1.1 |
| Duplication cyst as most likely | 1 | 0.6 |
| RCC as most likely | 2 | 1.1 |
| Pseudocyst as most likely | 1 | 0.6 |
| Mesenteric cyst as most likely | 1 | 0.6 |
| MesoblasticNephroma as most likely | 2 | 1.1 |
| Ovarian teratoma as most likely | 2 | 1.1 |
| Caroli's disease as most likely | 3 | 1.7 |
| Cirrhotic liver with regenerative nodules | 1 | 0.6 |
| Ovarian tumor | 3 | 1.7 |
| Biliary hamartoma | 1 | 0.6 |
| Multicystic dysplastic kidney | 1 | 0.6 |
| Cecal mass likely benign | 1 | 0.6 |
| Renal clear cell Ca most likely | 1 | 0.6 |
| Mesenteric mass | 2 | 1.1 |
| Known dysgerminoma | 1 | 0.6 |
| Hepatocellular carcinoma-HCC as most likely | 2 | 1.1 |
| Known hemangioendothelioma | 1 | 0.6 |
| Choledocal cyst | 1 | 0.6 |
| Multicompartment mass with biopsy recommended | 1 | 0.6 |

Among patients with Wilm’s tumor (both known and Wilm’s as most likely), 36 (51.5%) had left sided tumor while 26 (37.1%) patients had right sided tumor and 8 patients (11.4%) had bilateral tumor[Figure5].

The size of these masses range from a minimum of 1 cm to maximum of 20 cms, with mean measurement of 11.68 cms. 60% of the patients have mass size measurement above 10cms in the largest dimension while 40% patients have mass size measurement of 1 to 10 cm in the largest measurement. 45(64.3%) of the patients had midline crossing to the opposite side.

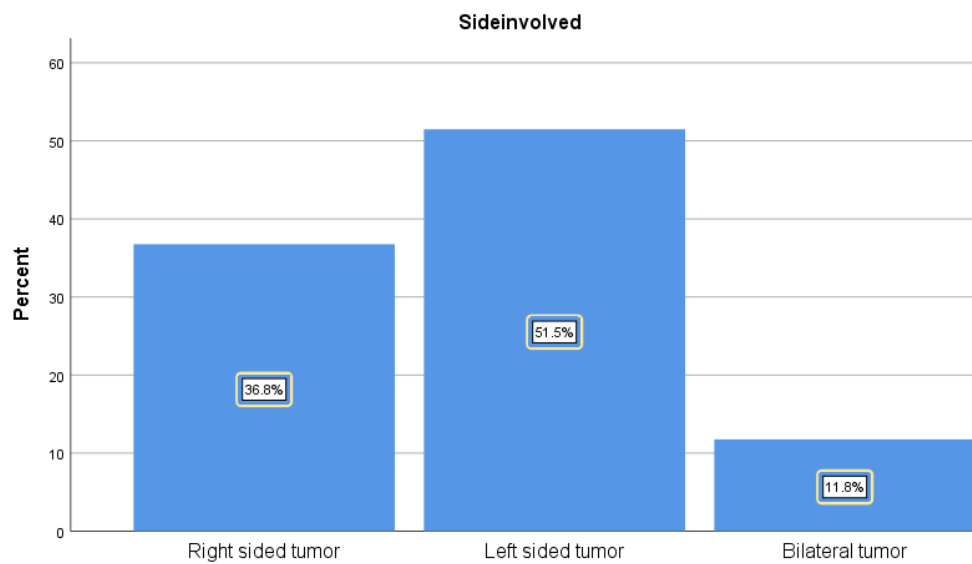


Figure 5: Bar chart Wilm’s tumor side involvement of pediatric patient imaged at Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019

Vascular involvement was seen in 44 (62.9%) of patients, among which vascular extension mostly into the renal vein and inferior vena cava accounts for 18 (25.7%) of the cases and vascular displacement was seen in 16(22.9%) patients [Figure 6].

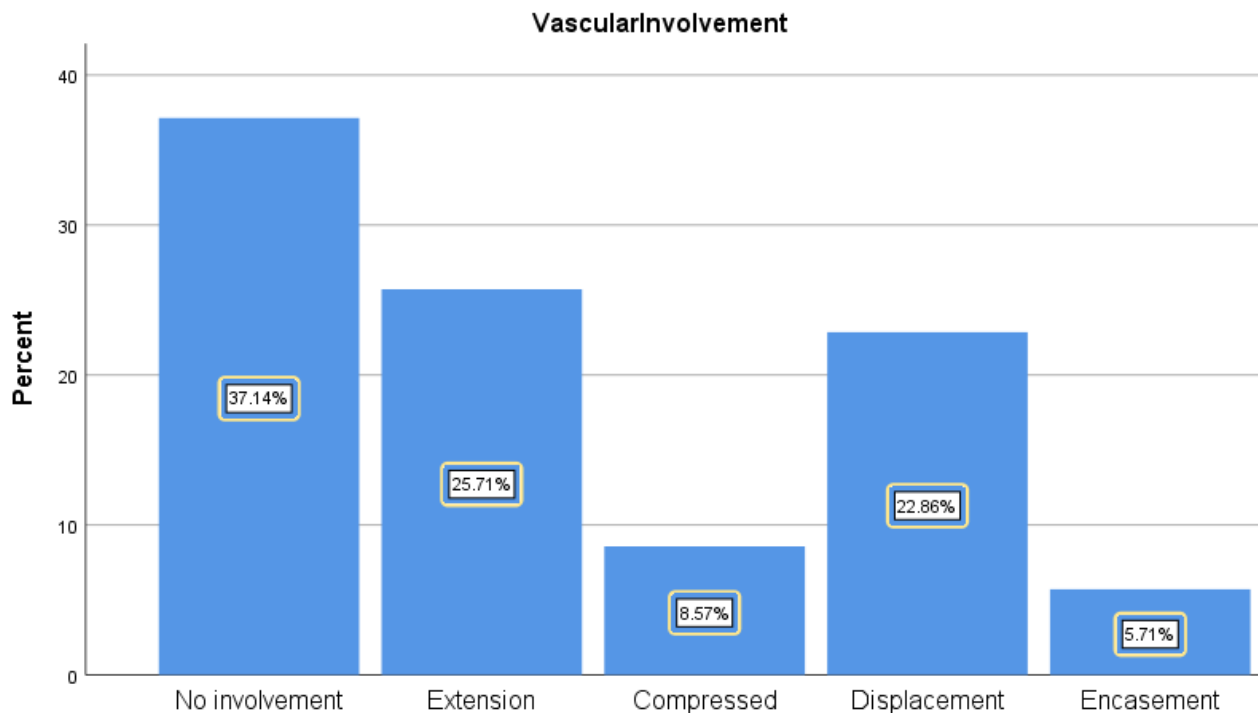


Figure 6: Patterns of vascular involvement in Wilm's tumor cases of pediatric patient imaged at Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019

Among Wilm's tumor patients, fat content was seen in none of the patients and calcification was seen in 4 (5.7%) of patients (two of the patients were post treatment and two were treatment naive) and there was adjacent organ involvement seen in 15 (21.4%) of patients. Associated lymphadenopathy was seen in 9 (12.9%) of patients with the size ranging from 1 to 5.8 cms.

There was no isolated bone involvement seen among patients with the conclusion of known Wilm's or likely Wilm's tumor patients.

Distant metastasis was seen on the imaging in 15(21.4%) of the patients with chest metastasis accounting for the majority of cases (73.3%). Other findings were seen in 19 (27.1%) of the cases which are ascites, perinephric collection and lung base findings. Hydronephrosis was seen in 10 (14.3%) of the cases.

Stage of Wilm's tumor was reported in 15 (21.4%) of the cases while the rest of the cases the findings were described.

Among the known Wilm's tumor patients with previous scans, 20(66.7%) were reported improved compared to previous scan, 7 (23.3%) had worsening and

3(10%) patients were stable in terms of mass condition as compared to previous scan.

Neuroblastoma, both known and likely neuroblastoma as a conclusion, accounts about 24 (13.7%) of the pediatric abdominal masses scanned. Of these, males account for 17(70.8%) and females 7(29.2%) and 12 patients (50%) of the patients are in the age group of 1 to 2 years of age, 8(33.3%) between 3 to 5 years of age and the rest 16.7% are between 6 and 8 years of age. [Table-7 and Figure-7]

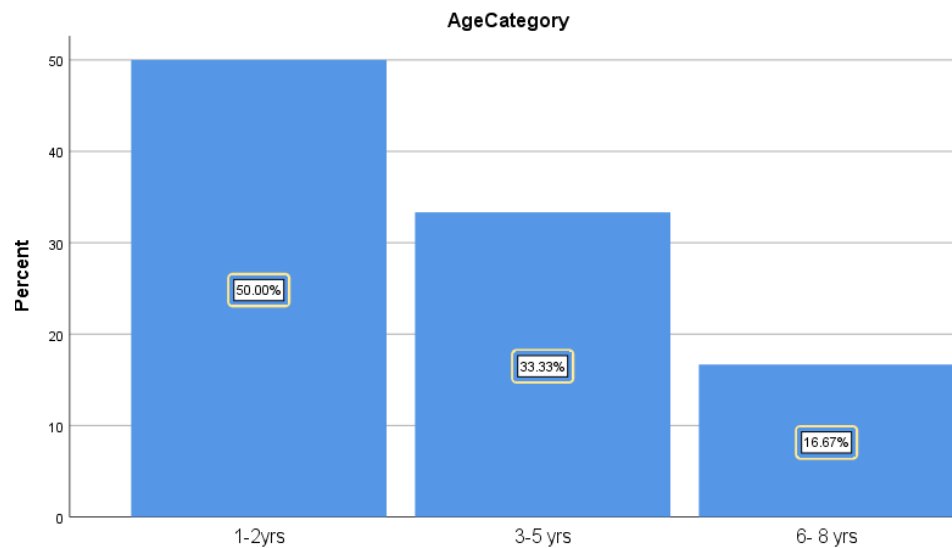


Figure 7: Age Distribution of Neuroblastoma patients scanned at Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019

Table 7: Distribution of neuroblastoma patients by sex and age category imaged at Tikur Anbessa Specialized Hospital radiology unit between May 1, 2018 and April 30, 2019

| Age category | Sex | | Total |
|----------------------|------|--------|-------|
| | Male | Female | |
| 1st month | 9 | 3 | 12 |
| 1 st year | 5 | 3 | 8 |
| 1-2 yrs | 3 | 1 | 4 |
| Total | 17 | 7 | 24 |

The size of the largest diameter of these patients vary widely ranging from 2.5 cms to 20 cm with mean diameter of 10.15cms. 21 patients(91.3%) had single lesion while the rest 8.7% of patients had multiple lesions seen on the abdominal CT.

20 (87%) of the neuroblastoma cases have midline crossing reported with 10(41.7%) were reported as left sided, 6(25%) right sided tumors.

22(91.7%) were reported as solid masses while 2(8.3%) were described as complex/mixed solid cystic masses. Vascular involvement was seen in 17(70.8%) in the form of encasement; displacement and compression seen in 1 patient each accounted 4.2 % each. On post contrast studies Heterogeneous contrast enhancement was seen 21(87.5%) and 2 (8.3 %) showed homogenous enhancement and 1(4.2 %) was hypo-enhancing.

18(75%) of the reported neuroblastoma patients calcification was seen and 2(9.1%) patients had foraminal involvement. None of the masses were described as having fat content.

11(45.8%) of patients had adjacent organ involvement and hydronephrosis was reported in 1(4.2%) of patients.

There was associated lymphadenopathy in 9(37%) of patients with the largest size measuring 2.4cms. Bone involvement was seen in 4(16.7%) of the patients and distant metastasis was seen in 8(33.3%) of patients with liver, lung and bone accounting for one third of the metastatic sites.

Other findings (ascites and lung base findings) were reported in 7(31.8%) of the cases. Stage of the diagnosis was reported in 4(22.2%) of cases while in the rest, findings were described.

The third most common diagnosis seen on computed scans of pediatric abdominal masses is lymphoma. Both known lymphoma and as most likely diagnosis, presenting with abdominal mass, accounted for total of 12.5%. Among the lymphoma cases, 4(20%) of them had distant metastasis while 40% of them had other findings (ascites and lung base findings).

RMS ranked fourth most commonly seen pediatric abdominal mass, accounting for 14(8%) of the identified abdominal masses.

4.2. DISCUSSION

Diagnostic imaging plays a crucial role in the early diagnosis and management of pediatric abdominal masses, local disease staging, identification of distant metastases, and monitoring response to therapy.

CT is currently the technique of choice in the diagnosis and staging of abdominal masses in children, and is particularly relevant in recognition of size and site of lesion. It also provides an excellent visualization of contiguous structures like vessels and lymph nodes.

Abdominal masses are not all of neoplastic origin, and such lesions as hydronephrosis, appendiceal abscess, congenital duplication of the bowel, pancreatic pseudocyst, choledochal cyst, and even tuberculous mesenteric adenitis may closely simulate large abdominal neoplasms.

This study has shown that 42.6% of the scanned abdominal masses had renal origin being the most common followed by adrenal and liver and biliary origin masses each accounting 9.7% and 9.1% of the reported cases respectively.

Our study has shown that of the identified organ of origin, 40.4% of patients have the diagnosis of known Wilm's or Wilm's tumor as most likely and 24(13.7%) patients have diagnosis of known neuroblastoma or neuroblastoma as most likely on final impression of their reports.

These findings are similar to those done previously in the same institution which was a retrospective analysis of 77 patients below the age of 15 years with childhood malignancy admitted to the pediatric wards of Tikur Anbessa Hospital (TAH) in Addis Ababa during a 2 year period from January 2005 up to December 2006. Malignancies accounted for 3.1% of all admissions during this period. The commonest malignancy was Wilm's tumor, which contributed for 19(24.7%) of cases. [10]

A retrospective study of 3 year period were carried out among all children aged below 15 years old admitted to the pediatric wards of Gondar University Hospital, Northwest Ethiopia. Of the total of 71 cancer cases diagnosed and admitted to the pediatric ward during the study period, 43 (60.6 %) were hematological malignancy followed by Wilm's tumor 13 (18.3 %), Neuroblastoma 5 (7 %), Rhabdomyosarcoma 3 (4.2 %), Brain tumor 3 (4.2 %), Hepatoblastoma 2 (2.8 %).[11]

Among the 71 Wilm's tumor patients, 39 were new diagnosis while the rest were known patients with follow up scans. This is to previous study done by V. Paintsil et al showed 40 cases in 2011, 28 cases in 2012, 52 cases in 2013, a total of 120 over the three years of the study period from 2011 to 2013.[12]

Table 8 Comparison of successive studies of newly diagnosed Wilm’s Tumor in Tikur Anbessa Specialized Hospital [12]

| | No. of new cases |
|------------------|---------------------------------------|
| 2011 | 40 |
| 2012 | 28 |
| 2013 | 52 |
| <i>Our study</i> | <i>39 as most likely and 32 known</i> |

Wilm’s tumor was seen in highest frequency in the 3-5 yr age group 35 patients (49.3%) which is similar to most literatures and demographic reports.

64.3% of the patients had midline crossing to the opposite side indicating late presentation and diagnosis thus affecting patient treatment outcome. These findings are similar to other studies done in Africa (Adegboyega, *et al.*: Wilms’ tumor and CT scan findings) where patient treatment and treatment facility accessibility is a major consequence of the low socio-economic state of the countries.

Heterogeneous contrast enhancement was seen in all cases of Wilm’s. [Table-9] but bilateral kidney involvement at diagnosis is seen in about 11% of the cases seen while in the study done in Nigeria by Adegboyega, *et al* the frequency of bilateral kidney involvement is about 25%, more frequent than our finding.

In our study, bilateral disease was seen in and lymph node enlargement was seen in 11.4 % and 12.9 % of the cases respectively which is slightly lower than those seen in Adegboyega, *et al* Wilms’ tumor and CT scan findings, the Nigerian experience. [Table-9]

Table 9 Comparison of CT Scan findings of Wilm's tumor in The Nigerian experience and our study [2]

| CT Scan findings | | |
|------------------------|------------------------|-----------|
| Findings | Percentage % | |
| | Olukayode, A.A., et al | Our study |
| Abdominal distension | 100 | 97 |
| Right sided tumor | 42 | 36.8 |
| Left sided tumor | 33.3 | 51.5 |
| Bilateral tumor | 25 | 11.7 |
| Tumor crossing midline | 75 | 64.3 |
| Calcification | 17 | 5.7 |
| Vascular involvement | 25 | 62.9 |
| LN involvement | 50 | 12.9 |
| Bone involvement | 0 | 0 |

5. CONCLUSION AND RECOMMENDATION

Wilm's tumor is the most common renal malignancy in childhood and it is the most common cause of renal mass in children in the western countries and African studies mentioned in the reference. This research depicts similar findings in our set up as well.

Presentation of Wilm's is usually with large painless abdominal mass with minority presenting with hematuria and other symptoms.

In contrast to neuroblastoma, either tumor extension or displacement seen rather than encasement as seen also in our study. The classical "rule of 10's" with 10% bilateral tumor, 10% showing calcification and 10% having pulmonary metastasis at presentation is also fairly seen in our study.

Our study showed that chest metastasis is the commonest pattern of metastasis in children with neuroblastoma, hence routine initial inclusion of the chest imaging for abdominal mass with CT scanning will need further study.

Neuroblastoma is also a common abdominal childhood tumor. Typically neuroblastoma occurs in early childhood with more than 80% seen in children of age 6 and less. The imaging characteristics of both Wilm's tumor and neuroblastoma are well described in this study.

Further pathologic radiologic correlation studies on the subject is recommended and its one limitation in this study.

6. LIMITATION

Histopathological correlation was not included in this study.

Reports that were incomplete for data collecting format were filled by the primary investigator reviewing the images.

Most of the CT studies were post contrast only to assess calcifications and degree of enhancement.

Discontinuity CT scan service in the department.

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Data Collection Format Page II

Mass Characterization

1. Size in cm in two dimension
2. Solid vs Cystic vs Mixed
3. Number of lesion in the involved organ
 - A. Single B. Multiple
4. Side Involved (if Applicable)
 - A. Right sided tumor B. Left sided tumor C. Bilateral tumor
5. Contrast enhancement
 - A. Heterogeneous B. Homogenous C. Non enhancing
6. Retroperitoneal Vs Peritoneal
7. Tumor crossing the midline A. Yes B. No
8. Calcification A. Yes B. No
9. Fat Content A. Yes B. No
10. Widening intervertebral neural foramina A. Yes B. No
11. Adjacent organ involvement A. Yes B. No
12. Vascular involvement
 - i. Encasement ii. Displacement iii. Compressed iv. Extension
13. Lymph Node enlargement
 - A. Yes if yes Size largest----- B. No
14. Bony involvement A. Yes B. No
15. Evidence of Distance metastasis i. Yes ii No
 - i. if yes Specify -----
16. Other findings
 - A. Ascites A. Yes B. No
 - B. Lung Base A. Yes B. No
17. Stage of the diagnosis
 - A. Reported B. Not Reported
18. If differential diagnosis is given
 - A. Infectious cause B. Metastasis
19. Evidence of hydronephrosis A. Yes B. No
20. Solid organ enlargement A. Yes B. No If Yes, specify-