Section: Radiology

Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY ON ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN THE DIAGNOSIS OF ABDOMINAL TUMORS WITH HISTOPATHOLOGICAL CORRELATION IN PEDIATRIC AGE GROUP IN A TERTIARY CARE HOSPITAL

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Received *: 04/04/2025*
Received in revised form *: 22/05/2025*
Accepted *: 12/06/2025*

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DOI: 10.70034/ijmedph.2025.3.16

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 88-97

ABSTRACT

Background: The aim is to study the accuracy of MDCT in the diagnosis of paediatric abdominal tumours and its effectiveness in differentiating benign from malignant tumours.

Materials and Methods: Pediatric Patients referred to the radiology department with USG findings suggestive of abdominal tumors and others clinically indicated. 70 Patients Both genders of Pediatric age group (0-18 years) who came to the Radiodiagnosis in the period of 24 months with relevant history and clinical examination were subjected to this study.

Results: In this study, out of 70 patients, most common pediatric abdominal tumour is Wilms tumour (n=17), followed by hepatoblastoma (n=13) and germ cell tumours (n=10). Equal number of Neuroblastoma and Lymphoma (n=8) is seen. In this study, sex distribution of 60% males and 40% females noted. Among NB cases, extending cross midline, 50% are adrenal in origin, 75% showed vascular encasement, 25% patients had distant metastasis. Coarse, amorphous calcifications are common in Neuroblastoma. All Teratoma cases are heterogenous with mixed solid cystic areas with calcifications and fat. Majority of hepatoblastoma cases are seen in males (84.6%). Mass and pain abdomen were common symptom/sign of hepatoblastoma after abdominal distension. 38% of hepatoblastoma showed associated tumour thrombus. 60% of RMS cases are females, most of them presenting with very large mass and had their origin in pelvic structures predominantly (60%) in bladder. Retroperitoneal lymphoma showed low attenuation on plain CT and homogenous enhancement on contrast studies and encasing vascular structures. 10 (14.28%) cases were of germ cell origin with 2 each of sacrococcygeal and retroperitoneal teratoma.

Conclusion: Contrast enhanced CT accurately localized site of origin, morphology of tumour relationship with neighbouring structures, vascular encasement or infiltration, tumour characteristics with necrotic areas. Besides CT also being considerably cost effective and widely available, it is preferred preoperative method of evaluating retroperitoneal mass in a child.

Keywords: Multidetector Computed Tomography, Ultrasonography, Neuroblastoma, Rhabdomyosarcoma.

INTRODUCTION

Abdominal lumps in children include a variety of lesions of diverse origin that may occur from the newborn period through adolescence.[1] They present a diagnostic challenge due to their diverse histology and varied clinical presentations. The patient's age is one of the most important factors that helps narrow

the potential differentials as certain masses are particularly common in certain age groups- neonatal, infantile, early childhood and adolescence. Relevant history regarding time since onset of mass, rapidity of growth and mass effect on adjacent structures may add further to this information. The presence of constitutional symptoms, such as pallor, anorexia, fever, or weight loss, may point toward a malignant lesion, although non-specific. The role of radiological imaging is to identify the precise location and extension of the pathologic process using the few essential imaging techniques. Most abdominal masses in children are initially imaged by Plain X-ray. They provide information about the location of the mass and presence or absence of calcific components.[1] However, children are exposed to radiation and have a limited role as only four basic densities (bone or mineral, soft tissue, fat, or air) are visualised.[2]

Ultrasound is a powerful initial imaging modality for the pediatric patients who present with abdominal symptoms since it does not have 5 radiation hazards. It allows imaging in multiple planes, permits repetitive examinations and requires no physiologic function for anatomic visualisation. It aids in assessment of vascularity by Colour and Duplex Doppler. Thus, USG is useful as a general screening procedure. However, USG is highly operator dependent and cannot obtain conclusive diagnostic and anatomy information due to restricted acoustic windows.

MDCT technology has proved some advantages for paediatric abdominal imaging such as shorter scanning time with increased spatial resolution, decreased sedation rate, less necessity for oral and I.V. contrast medium application, and regulated radiation exposure. MDCT with multiplanar reconstructions provide vital information regarding location of the lesion, its organ of origin, enhancement characteristics in various phases of contrast administration, presence of necrotic areas & calcifications, areas of fat attenuation, extensions of the lesion, involvements & invasions and mass effect on adjacent structures. When a malignant lesion is suspected, CT scan of the chest, abdomen, and pelvis can be done to determine local extent with 'look for distant metastases. MRI has been used commonly for Cross-sectional imaging because of its multiplanar imaging capability. However, it still has some difficulties to be the imaging modality of choice for abdominal examinations of non- cooperative children because of the requirement of breath-holding to obtain motion artefact-free images, especially for contrast-enhanced studies, and longer scanning time resulting in an increase in sedation duration. Shorter imaging time with thinner slice thickness of MDCT has solved most of these problems.[3]

The ability to acquire volumetric datasets with optimised data acquisition and contrast delivery timing is a key advantage of MDCT. The goals of the comprehensive CT study in paediatric abdominal tumours are to optimise detection of the presence of the tumour; determine the extent of the tumour (staging); help define patient management (surgery or chemotherapy).

MATERIALS AND METHODS

Pediatric Patients referred to the radiology department with USG findings suggestive of abdominal tumors and others clinically indicated from the following teaching hospitals attached to Osmania medical college/ MNJ institute of oncology and regional cancer centre 3. Niloufer hospital for women and children. 70 Patients who came to the Radiodiagnosis in the period of 24 months from august 2022 to july 2024 with relevant history and clinical examination were subjected to this study.

Inclusion Criteria

Both genders of Pediatric age group (0-18 years). All pediatric patients referred to the radiology department with clinical and USG findings suggestive of abdominal tumors.

Exclusion Criteria

Patients with a history of allergic reaction to contrast media, raised levels of creatinine, who are unable to cooperate for the procedure.

Patients in the age group 0 to 18 years with suspected abdominal mass were examined by:

- 128 slice CT (make: Hitachi) (model: sceneria) in OGH

-16 slice CT (make: Toshiba) (model: aquilion-16) in Niloufer Hospital -128 slice CT (make: Siemens) (model: somatom) in MNJ Hospital.

Patients were kept NPO for 4 hrs prior to exam to avoid complications while administering contrast medium. Risks of contrast are explained to the patient / attendant and consent was obtained prior to the contrast study.

Technique: Patients were positioned in the CT gantry in the supine position with arms up. Antero-posterior plain topogram of the abdomen was performed initially with the breath held (if possible). Scan from top of liver or Diaphragm to either iliac crest or pubic symphysis depending on area of interest, with acquired slice thickness of 2.5mm, which were reconstructed to 0.75-1mm (depending on make and model of the machine). Plain CT scans of head and neck are obtained in selected cases suspected of having metastasis.

In all cases, plain scan was followed by triple phase contrast scan. 2ml/kg of iohexol, Non-ionic contrast medium (omniPaque) with maximum dose of 100ml (dose:600 mg.l/kg) at a flow rate of 0.07ml/kg/sec was injected and repeat topogram was taken after a scan delay of BT100+35sec, followed by acquisition of arterial and venous phases after 30 to 40 sec and 4 to 5 min respectively. Post study reconstructions of sagittal and coronal sections are performed. The scans were reviewed on a direct display console in multiple window settings (i.e. soft tissue window, lung window and bone window).

The lesions were evaluated in terms of location, organ of origin, CT characters (Including pre and post contrast attenuation, enhancement, Presence of necrosis, cystic changes and calcifications) and extensions. Based on the age of the patient and the CT characters, provisional and differential diagnoses were given.

These were correlated with the final diagnosis obtained after surgical and histopathological examination and the sensitivity of CT in locating and characterising various abdominal masses calculated.

Statistical Methods: Descriptive statistical analysis has been carried out in the present study. Diagnostic statistics such as sensitivity, Specificity, PPV, NPV and Accuracy has been used to find the correlation of CT scan diagnosis with final diagnosis using 2x2 contingency table.

RESULTS

A prospective observational study to evaluate abdominal tumours in paediatric age groups using computed tomography. The description analysis of my study is as follows:

Table 1: Age and gender distribution of study population.

Age Group	No. of Patients	Percentage
<1 year	16	20%
1-2 years	9	12.85%
2-3 years	6	8.52%
3-4 years	7	10%
4-5 years	5	7.10%
5-7 years	10	14.20%
7-9 years	3	5.68%
9-13 years	7	10%
13-15 years	1	1.42%
15-18 years	6	10%
Gender		
Male	42	60%
Female	28	40%

There was wide variation in age incidences of various abdominal tumours in the sample group. Most tumours presented below the age of 1 (20%) followed by between 5-7 years (n=10). Males (60%) were more commonly effected than females (40%) 60.

Table 2: Distribution of cases.

CT Diagnosis	No. of Patients	Percentage
Wilms Tumor	17	24%
Hepatoblastoma	13	18.57%
Lymphoma	8	11.42%
Neuroblastoma	8	11.42%
Germ Cell Tumour	10	14.28%
Rhabdomyosarcoma	5	7.14%
Metastasis	2	3%
Adrenocortical Carcinoma	1	1.42%
Mesoblastic Nephroma	1	1%
Leukemia	1	1.42%
Cystic Nephroma	1	1.42%
Mesenchymal Hamartoma	1	1.42%
Spen	1	1.42%
Hemangioendothelioma	1	1.42%

In this study, Wilms tumour (24%) is most common abdominal tumour followed by hepatoblastoma (18.57%). There are 17 cases of Wilm's tumour in this study, of which 13 patients are male and only 4 are female.

Table 3: Age and gender distribution of tumors

Wilms Tumor	Male	Female	Total
<1 year	4	1	5
1-3 year	2	0	2
3-5 year	3	1	4
5-7 year	2	1	3
7-10 year	1	0	1
10-15 year	1	1	2
15-18 year	0	0	0
total	13	4	17
Hepatoblastoma			
<1 year	5	1	6
1-2 year	3	0	3

2-3 year	1	0	1
3-5 year	1	0	1
5-9 year	1	1	2
total	11	2	13
Neuroblastoma			
<1 year	1	0	1
1-2 year	1	1	2
2-4 year	1	1	2
4-10 year	1	2	3
total	4	4	8
Lymphoma			
1-2 year	1	0	1
2-3 year	1	0	1
3-5 year	1	0	1
5-10 year	1	1	2
10-18 year	1	2	3
total	5	3	8
Germ Cell Tumors			
<5 year	2	2	4
5-10year	0	2	2
10-18 year	1	3	4
total	3	7	10
RMS			
<1 year	1	0	1
1-5 year	1	2	3
5-7 year	0	1	1
total	2	3	5

There were 13 patients of hepatoblastoma out of the 70 patients included in our study. 11 were male and 2 were female of which 1 female patient was 1 year old. Most of the patients with hepatoblastoma presented with abdominal distension (n=8) followed by pain and mass per abdomen (n=7). There are 8 cases of lymphoma in our study of which 5 are males and 3 are female patients. There are no case of lymphoma which presented below 1 year in our study.

Table 4: Characteristics of wilms tumor

Signs/Symptom	**Number of Patients**	**Percentage**
Mass Per Abdomen	11	64.71%
Pain Abdomen	11	64.71%
Weight Loss	2	11.76%
Vomitings	5	29.41%
Abdomen Distension	7	41.18%
Loss Of Appetite	8	47.06%
Hematuria	12	70.59%
Ct Characteristics		
Calcification	3	18%
Necrosis	5	29%
Vascular Encasement	2	12%
Hemorrhage	2	12%
Lymphadenopathy	3	18%
Mass Effect	11	65%
Tumor Thrombus	4	24%
Claw Sign	6	35%
Peritoneal Spread	2	12%
Location		
Right Kidney	9	52.94%
Left Kidney	7	41.18%
Bilateral Kidney	1	5.88%
Stage		
I	8	47.06%
II	1	5.88%
III	3	18%
IV	4	24%
V	1	5.88%
Metastasis		
Lungs	2	12%
Bones	1	5.88%
Liver	1	5.88%

Most of the patients with Wilms tumour presented with hematuria (70.59%) followed by pain and mass per abdomen (64.71%). Claw sign and mass effect were more commonly seen in Wilms tumour. Most of them were seen originating from right kidney and 4 cases showed tumour extension into adjacent vessels,

of which 2 were into right renal vein, 1 was in left renal vein and 1 showed tumour thrombus in right renal vein and IVC. Most of the cases presented in stage 1 (47.06%). Of the 4 cases which presented in stage 4 (hematogenous metastasis) 2 were to lungs and one to bone and liver respectively.

Table 5: Characteristics of Hepatoblastoma

Signs/Symptom	Number of Patients	Percentage
Mass Per Abdomen	7	53.85%
Pain Abdomen	7	53.85%
Weight Loss	4	30.77%
Vomitings	5	38.46%
Abdomen Distension	8	61.54%
Loss of Appetite	4	30.77%
CT Characteristics		
Calcification	3	23%
Necrosis	3	23%
Vascular Encasement	4	31%
Lymphadenopathy	4	31%
Mass Effect	6	46%
Tumor Thrombus	5	38%

Hepatoblastoma showed tumour thrombus in 5 of the 13 patients in our study (38%) of which 1 was into hepatic veins and the rest of them showed thrombus in portal vein.

There were total 8 cases of neuroblastoma in our study with equal incidence in both genders. Only one case presented below 1 year age and was male.

Table 6: Characteristics of Neuroblastoma

Signs/Symptom	Number of Patients	Percentage
Mass Per Abdomen	3	37.50%
Pain Abdomen	3	37.50%
Weight Loss	2	25%
Vomitings	2	25%
Abdomen Distension	5	62.50%
Loss Of Appetite	4	50%
Limb Weakness	4	50%
Location		
Bilateral Adrenal	1	12.50%
Right Adrenal	2	25%
Left Adrenal	1	12.50%
Non-Adrenal	4	50%
CT Characteristics		
Calcification	6	75%
Necrosis	1	12.50%
Vascular Encasement	6	75%
Spinal Extension	2	25%
Lymphadenopathy	6	75%
Mass Effect	6	75%
Staging		
L1	2	25%
L2	4	50%
M	2	25%
Metastasis		
Bones	1	12.50%
Liver	1	12.50%

Abdominal distension was most common presentation of neuroblastoma (62.5%). Half of the neuroblastoma cases presented with limb weakness and loss of appetite (50%). Half of the neuroblastoma cases in our study were from adrenal glands of which 50% were from right adrenal gland. Most of the neuroblastoma cases showed vascular encasement, mass effect, calcifications and associated lymphadenopathy (75%). 2 cases showed metastasis of which one was to liver and other was to bones. According to INRG staging of neuroblastoma, half of them were in stage L2 at presentation.

All of the lymphoma cases in our study presented with pain abdomen. Next most common presentation was vomiting and loss of appetite.

Table 7: Characteristics of Neuroblastoma Lymphoma

Signs/Symptom	Number of Patients	Percentage
Mass Per Abdomen	4	50.00%
Pain Abdomen	8	100.00%
Weight Loss	4	50.00%

Vomitings	6	75.00%
Abdomen Distension	4	50.00%
Loss Of Appetite	6	75.00%
Location		
Para Aortic L. N.	4	50.00%
Small Bowel	2	25.00%
Liver	1	12.50%
Kidney	1	12.50%
CT Characteristics		
Calcification	1	13%
Necrosis	2	25%
Vascular Encasement	6	75%
Spinal Extension	8	100%
Lymphadenopathy	4	50%
Mass Effect	1	13%
Staging		

Half of the lymphoma cases originated from retroperitoneal para- aortic lymph nodes; other half originated in solid of organs. On CT, about three fourths of all lymphoma cases (75%) in our study showed vascular encasement and almost Half of them showed mass effect with least (1%) showing calcifications. Germ cell tumours constituted about 10 out of the total 70 cases of abdominal tumours in our study, of which 4 GCTs are in ovary and 2 each are retroperitoneal, sacrococcygeal. The ovarian GCTs were all in above 5-year-olds.

Table 8: Characteristics of Rhabdomyosarcoma

Signs/Symptom	**Number of Patients**	**Percentage**
Mass Per Abdomen	3	30.00%
Pain Abdomen	7	70.00%
Weight Loss	6	60.00%
Vomitings	1	10.00%
Abdomen Distension	5	50.00%
Location		
Ovary	4	40.00%
Retroperitoneum	2	20.00%
Sacrococcygeal	2	20.00%
Pancreas	1	10.00%
Prostate	1	10.00%
CT Characteristics		
Calcification	7	70%
Solid Cystic	7	70%
Fat	5	50%
Peritoneal Spread	2	20%

A total of 5 cases of Rhabdomyosarcoma are there in this study of which 2 are males and 3 are females. 3 cases had their site of origin in bladder wall, and 1 case out of 2 males was seen arising from prostate and one was seen arising from uterus.

Table 9: Characteristics of RMS

Signs/Symptom	**Number of Patients**	**Percentage**
Mass Per Abdomen	2	40.00%
Pain Abdomen	3	60.00%
Loss Of Appetite	1	20.00%
Hematuria	3	60.00%
Location		
Bladder	3	60.00%
Uterus	1	20.00%
Prostate	1	20.00%
CT Characteristics		
Calcification	2	40%
Solid Cystic	1	20%
Fat	1	20%
Peritoneal Spread	1	20%

Most of the cases of rhabdomyosarcoma (60%) presented clinically with hematuria and pain abdomen.

Table 10: Correlation of CT diagnosis with HPE diagnosis – an observation

CT diagnosis	**True positive**	**False positive**	**False negative**	**True negative**	**Total**
Wilms Tumor	14	3	1	52	70
Hepatoblastoma	12	1	0	57	70

Lymphoma	5	3	0	62	70
Neuroblastoma	8	0	1	61	70
Germ Cell Tumour	9	1	0	60	70
Rhabdomyosarcoma	5	0	2	63	70
Leukemia	1	0	1	68	70
Metastasis	2	0	0	68	70
Mesoblastic Nephroma	1	0	1	68	70
Mesenchymal Hamartoma	0	0	1	69	70
Renal Cell Carcinoma	0	0	1	69	70
Miscellaneous	4	0	0	66	70

Table 11: Crrelation of CT diagnosis with HPE diagnosis – an evaluation

CT diagnosis	Sensitivity	Specificity	PPV	NPV	Accuracy
WILMS TUMOR	93.33%	94.55%	82.35%	98.11%	94.29%
HEPATOBLASTOMA	100%	98.28%	92.31%	100%	98.57%
LYMPHOMA	100%	95.38%	62.5%	100%	95.7%
NEUROBLASTOMA	88.89%	100%	100%	98.39%	98.57%
GERM CELL TUMOUR	100%	98.36%	90%	100%	98.57%
RHABDOMYOSARCOMA	71.43%	100%	100%	96.92%	97.14%
LEUKEMIA	50%	100%	100%	98.85%	98.57%
METASTASIS	100%	100%	100%	100%	100%
MESOBLASTIC NEPHROMA	50%	100%	100%	98.55%	98.57%
MESENCHYMAL HAMARTOMA	0	100%	0	98.57%	98.57%
RENAL CELL CARCINOMA	0	100%	0	98.57%	98.57%
MISCELLANEOUS	100%	100%	100%	100%	100%

Contrast enhanced CT is 100% sensitive and 98.28% specific in diagnosing Hepatoblastoma. CECT is also 88.89% sensitive and 100% specific in diagnosing Neuroblastoma. The sensitivity and specificity of CECT in diagnosing Wilms tumour is 93.33% and 94.55% respectively.

A 100% sensitivity and specificity of CECT is seen in diagnosing Metastasis, adrenocortical carcinoma and SPEN in our study due to small sample size. CECT is 100% sensitive and 95.38% specific in diagnosing Lymphoma.

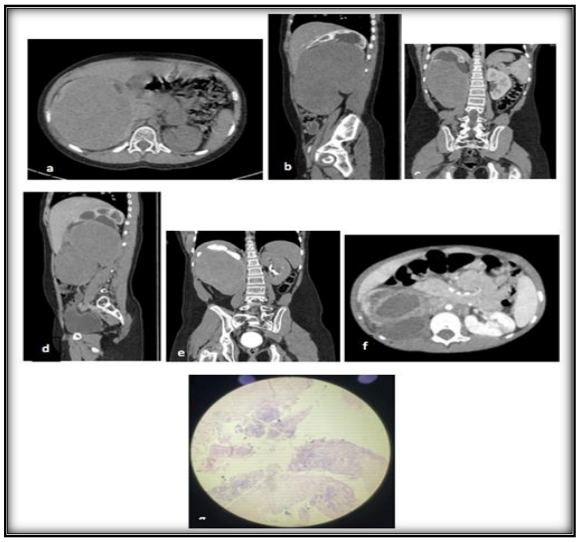

Figure 1: a-plain axial; b- sagittal arterial phase; c& d-coronal and sagittal venous phase MDCT images show large well defined heterogeneously enhancing solid-cystic lesion arising from inferior pole of right kidney with claw sign in a 11 yr. old male with pain abdomen; e- delayed phase shows contrast filled collecting system displaced superiorly by the mass. Imaging diagnosis given as Wilms tumour concordant with (g) HPE; f- another patient with Wilms tumour shows tumour like density in right renal vein and IVC indicating tumour thrombosis.

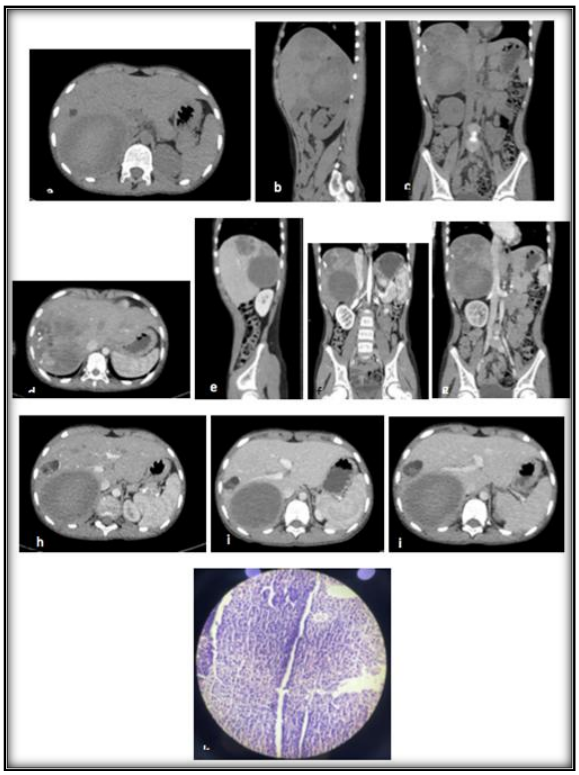

Figure 2: a-c: axial, sagittal & coronal plain CT images; d-g: axial, sagittal & coronal portal venous phase images show a large heterogeneously enhancing hypodense solid-cystic lesion in right lobe of liver in a 13 yr. old with weakness & weight loss complaints. Imaging and HPE (k) diagnosis were consistent with Hepatoblastoma; h-j: Incidentally, small well defined hypodense hemangioma was noted adjacent to hepatoblastoma which shows nodular arterial phase enhancement with centripetal venous phase filling.

DISCUSSION

Maximum number of cases (62.8%) in this study are less than 5 years of age, with peak incidence in age

group below 1-year. Majority of Wilms tumour cases (32.5) were in age range of 3-5 years, with peak incidence in below 1 year of age in this study. 65% of cases are in children less than 5 years of age. Bernstein et al,[4] also reported approximately 75%–80% of cases occur in children younger than 5 years of age, which is close to this study. All cases of hepatoblastoma in this study were below 10-year age. Majority of hepatoblastoma cases (84.6%) were below 5 years of age. Darbari, Anil et al.[5] Reported similar incidence (91.3%) of hepatoblastoma below 5 years age. Majority of Neuroblastoma cases (37.5%) were in age below 3 years, and patients less than 5 years of age constituted 62.5% of total neuroblastoma cases. However, Ora I et al,[6] reported 90% of neuroblastoma cases occur in children less than 6 years of age slightly differing from our study. Out of 8 cases of lymphoma in this study, 3 are less than 5 years of age, one fourth of the cases were in 5-10 year age group which was similar to that reported by Rubesin, S E et al,[7] where more than one third of lymphoma cases were in age group of 5-9 years. Most cases of teratoma are above 10 years of age. All of Rhabdomyosarcoma cases were less than 7 years of age in this study.

In this study there were more females (60%), compared to males accounting for 40% of cases. There is male preponderance of Wilms tumour with 76.4%. Males had more incidence of hepatoblastoma (84.6) and only 2 out of 13 cases were seen in females. Among neuroblastoma, males and females constituted equal number of cases. 62.5% of lymphoma cases were males. Out of 5 cases of Rhabdomyosarcoma, 3 are females and 2 are males. Majority of cases of teratoma are females (70%). In this study, Commonest pediatric abdominal tumour is Wilms tumour accounting for 24% of total cases and hepatoblastoma is second commonest accounting for another 18.57% of cases. This is consisting with Lowe et al.[8] Who reported Wilms tumour to be the most common pediatric abdominal tumour.

Most common sign / symptom of Wilms tumour is Hematuria (70.59%) followed by abdominal mass and abdominal pain (64.71%) in this study. These findings did not correlate with study by Lowe et al,[8] who had reported mass per abdomen as more common presentation of Wilms tumour. In this study there is slightly more right kidney (52.94%) involvement compared to left kidney (41.18%) and bilateral renal involvement is seen in one case (5.88%) which is similar to study by Pastor et al,[6] who had reported similar renal involvement. Lowe et al,[8] in their study claimed that bilateral renal involvement occurred in 4-13% of children. Heterogenous enhancement were seen in all patients (100%) with mass effect in 65% cases. Calcifications are seen in 18% of cases, midline extension of tumour is seen in 12% of cases. In comparison Neuroblastoma had calcifications and midline extension in 75% of cases equally, suggesting calcifications and midline extension of tumour are much more common in neuroblastoma than in Wilms tumour. Scott et al,[2] stated that tumours that crossed midline were suggestive of neuroblastoma rather than Wilms. Gellar et al,[9] reported only 13% of Wilms tumour has calcifications which is similar to this study. Renal vein, Inferior vena cava involvement with tumour thrombus is seen in 24%of cases, which is slightly high compared to study by Scott et al,[2] who had reported vascular involvement by tumour thrombus in 11% of Wilms tumours. In this study, 2 patients had metastasis to lungs, which is most common site of distant metastasis according to literature followed by liver.

3 cases of Wilms were diagnosed as RCC, rhabdoid tumour and mesoblastic nephroma on histopathology. They are very rare in children and can have similar imaging features as Wilms tumour and is difficult to differentiate on imaging studies. No case of cystic Wilms was seen in his study, however, one case of cystic nephroma is seen. Peritoneal deposits and ascites were seen in 2 cases, which is suggestive of tumour rupture with peritoneal dissemination. Diagnosis of tumour rupture is important in staging and therapy planning. Three cases (18%) of Wilms tumour showed enlarged retroperitoneal lymph nodes. Majority of cases in this study are stage I and stage IV.

Abdominal distension (61.54%) followed by mass and pain abdomen (53.85%) are the more common presentation in hepatoblastoma patients which is similar to that reported in the study by Adebunmi et al.[10] Majority of them were heterogeneously enhancing with 38% of them hypoattenuated on MDCT. 23% of hepatoblastoma cases show calcification which is lower than that reported by Schooler GR et al,[11] where 50% of hepatoblastomas showed calcification. 5 cases of Hepatoblastoma showed tumour thrombus in our study (38%) of which 1 was into hepatic veins and the rest of them showed thrombus in portal vein. 1 case showed metastasis to lungs which is the most common site of metastasis in hepatoblastoma according to Towbin AJ et al,[12] 1 case of hemangioendothelioma is seen. Another case reported as hepatoblastoma is mesenchymal hamartoma on HPE. 2 cases were reported to be metastasis to liver from sarcomatous tumour origin. One case of SPEN is seen in this study.

Most common symptom in neuroblastoma patients is abdominal distension (62.5%). Limb weakness was seen in 50% of them in which secondary to intraspinous extension of tumour is seen in two patients (25%). Matthay KK et al,[13] in their study reported similar clinical presentations in neuroblastoma patients. 50% of Neuroblastoma were adrenal in origin and 50% of neuroblastomas are extra-adrenal in origin along sympathetic chain. Rha SE et al,[14] reported lower incidence of about 30 – 35% of neuroblastomas occurring in extra-adrenal retroperitoneum. Majority of cases (87.5%) showed heterogenous enhancement with areas of necrosis. Encasement of vessels (aorta, SMA, celiac trunk, renal vessels) without causing luminal stenosis is

seen in majority 75% of Neuroblastoma cases. Calcifications, most commonly coarse type were seen in 75% of cases and one third of cases showed extension of tumour across midline. Bittman et al,[15] Reported about one third cases of Neuroblastoma to have calcifications. Two patients (25%) had distant metastasis in this study, one showed to bone and other to liver. Bittman et al,[15] in their study described. Most common symptom in neuroblastoma patients is abdominal distant metastasis at presentation in two-thirds of children with abdominal neuroblastoma which is slightly more compared to this study. Majority of patients in this study are of stage L2 accounting for 50%. One case reported as neuroblastoma on imaging, due to vascular encasement with specks of calcification in retroperitoneum not crossing midline was given lymphoma on HPE.

Majority of cases (62.5%) are of age more than 5 years with male: female ratio of 5:3. 4 cases (50%) showed midline mass encasing aorta and its branches and 4 cases (50%) showed bowel and solid organ involvement. Three cases in this study (75%) are non-Hodgkin's type and one case is Hodgkin's type. Bragg et al,[16] reported NHL is more common than HL in children and prevalence of NHL increases steadily with age throughout the life. All cases (100%) showed mild but varied enhancement with 2 showing necrotic areas (25%) which is differentiating feature with neuroblastoma, where 89% of neuroblastoma showed heterogeneous enhancement with areas of necrosis. Calcifications is seen one of the cases, which is also a differentiating feature with neuroblastoma (84% of neuroblastoma showed calcifications). Vascular encasement without compression and midline extension was seen in 75% and 50% of the cases. 25% cases showed solid organ involvement of which 1 case (12.5%) is in kidney and liver each. David M Biko et al.[17] Reported similar incidences wherein 14% of lymphomas were seen in liver.

2 cases of leukemic infiltrates are seen, of which one case reported as infarct on imaging and was leukemic infiltrates on HPE.

Majority of germ cell tumours in this study are females (70%). Davidson et al.109 in their study described females outnumbered males by a ratio of 3.4:1 and 50% of cases were less than 6 months of age. 30% of patients presented with abdominal lump with pain abdomen being most common presentation. Most cases are well defined, complex predominantly cystic masses. Fat was seen in 50% of cases and calcifications in 70% of cases. Davidson et al,[17] in their study demonstrated calcifications in 92%, fat in 62% of Teratoma cases. One case given as GCT on imaging turned to be rhabdomyosarcoma prostate. There was one rare case of pancreatic GCT is seen.

Age group of cases were all below 7 years with a female preponderance. pain abdomen is the most common symptoms. Lane F. Donnelly et al,[18] reported in their study, peak incidence of RMS was seen between 3-6 years of age with slight male predominance (2:1). Majority of RMS cases (60%) in this study presented with pain abdomen and hematuria. According to Lane F. Donnelly et al,[18] hematuria and dysuria like urinary symptoms can be seen in pelvic RMS. All the cases showed heterogenous enhancement and with majority of them showing ill-defined margins. 40% of RMS cases showed calcifications. Peritoneal spread is seen in one case (20%). One case which is reported as germ cell tumour on CT, is rhabdomyosarcoma in HPE. Another rare case of biliary tract RMS was noted.

In the present study, most cases are well defined masses (n=39, 55.4%). Masses have soft tissue attenuation (n= 64, 94.2%), cystic areas (n=29, 41.4%), calcifications (n=25, 35.7%) and fat density (n=7, 10%) in decreasing order of frequency. Masses showed heterogeneous (n= 53, 75.7%), homogenous (n=5, 7.1%), peripheral (n=3, 4.2%) and minimal enhancement (n=9, 12.8 %). Involvement of adjacent structures by the abdominal masses was noted in 58.5% (n=41) cases. All 70 cases are verified histologically. CT findings were comparable with histopathological findings in 62 cases. All 21 cases that were characterised as Benign were proven to be benign by histopathology. 42 of the 49 cases that were characterised as Malignant in CT were proven by histopathology but 7 cases that was thought to be malignant, turned out be benign in histopathology like lymphoma, mature teratoma. There was difficulty in one case of lymphoma which showed specks of calcifications and was given as neuroblastoma on imaging. Another 2 cases showing imaging features of Wilms were given as renal cell carcinoma and rhabdoid tumour on HPE. One case of RMS was misdiagnosed as teratoma due to presence of fat attenuation.

CONCLUSION

MDCT technology has evolved significantly, with modern scanners offering high spatial resolution, multiplanar reformatting, and advanced post-processing techniques. These advancements have enhanced the diagnostic accuracy of MDCT in pediatric abdominal imaging, allowing for precise tumor localization, characterization, and staging. In this study we concluded most patients presented with in 1st five years of life, Males are slightly predominant. Patients presented most commonly with mass abdomen, pain abdomen, abdominal distension, hematuria and weight loss. Most common tumour was Wilms followed by hepatoblastoma. We conclude, MDCT plays a crucial role in early diagnosis, characterisation and staging of pediatric abdominal tumours. It helps in determining the resectability of tumors, guiding biopsy and surgical planning, and assessing treatment response.

Challenges and Limitations: Despite its diagnostic utility, MDCT has limitations, particularly in pediatric patients. The use of ionizing radiation in

MDCT raises concerns regarding radiation dose exposure, especially in children. Efforts to reduce radiation dose, such as the use of low-dose protocols and iterative reconstruction techniques, are essential to minimize the risk of radiation-induced malignancies.

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