Section: Radiology

Original Research Article

A STUDY ON FUNCTION OF MULTISLICE COMPUTED TOMOGRAPHY UROGRAM IN DESCRIBING FOCAL RENAL LESIONS IN A TERTIARY CARE HOSPITAL

Prashanth H V[1], Mishal Mohammed M M[2], Deepa Krishnaswamy[3]

[1]Associate Professor, Department of Radiodiagnosis, Karuna Medical College, Palakkad, Kerala, India.
[2] Professor, Department of Radiodiagnosis, Karuna Medical College, Palakkad, Kerala, India.
[3]Senior Resident, Department of Radiodiagnosis, Karuna Medical College, Palakkad, Kerala, India.

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Corresponding Author:
Dr. Deepa Krishnaswamy,
Email: prashanthrad2002@gmail.com

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Abstract

Background: A Computed Tomogram (CT) is valuable for distinguishing renal lesions as either solid or cystic. It further divides cystic lesions into five categories based on the probability of malignancy. The objectives are to identify CT characteristics of renal lesions on Multislice Computed Tomography Urogram (CTU) with intravenous contrast administration in various clinical presentations (Sample size =50 patients) in different age groups (4 yr.-79 yr.). to identify the extent, mass effects, vascularity, and components of focal renal-lesions & to detect any local or distant organ involvement after intravenous contrast administration on multislice CTU. **Materials and Methods:** Study Design: A prospective hospital-based observational study. Study area: Department of Radio Diagnosis, Karuna Medical College & Hospital, Chitoor, Palakkad Study Period: 1 year. Study population: Data for the study, has been collected among patients who visited the department of Radio diagnosis attached to Karuna Medical College & Hospital, Chitoor, PALAKKAD with suspicious renal lesions. Sample size: The study consisted of 50 subjects. Sampling method: Simple random technique. **Result:** In comparison to benign, malignant renal lesions contained a significantly higher proportion of necrosis (100% Wilms tumour & 58% in RCC). Renal vein involvement was observed among malignant renal lesions as much as 33.3% in RCC & 1 case (100%) Wilms tumour; however, this finding was not observed in any of the benign renal lesions. 3 out of 12 (16.7%) RCCs had IVC thrombosis. **Conclusion:** With a sensitivity of 100%, a specificity of 94%, & an accuracy of 96%, Multislice CTU was able to distinguish a benign lesion from a malignant one, with the acquired images being analyzed in their plain, cortico-medullary, & nephrographic- phases respectively. A rise of more than 20 HU in contrast was seen in RCCs, which displayed a heterogeneous enhancement. Invasion of the renal vein as well as IVC was highly specific for the presence of malignancy.

INTRODUCTION

A Computed Tomogram (CT) is valuable for distinguishing renal lesions as either solid or cystic, and it further divides cystic lesions into five categories based on the probability of malignancy. CT exhibits a high sensitivity in identifying renal lesions. Due to this capability, CT is frequently utilized to assist the radiologist in determining whether surgical removal of a kidney lesion is recommended, if further imaging studies are needed, or if it can be managed conservatively.

RCC patients often present between the ages of 50 and 70, with a 2:1 male predominance.[1,2] RCCs are thought to be the eighth most prevalent adult cancer, accounting for 2% of all malignancies and are responsible for 80-90% of primary malignant adult renal neoplasms.[3,4] Males are more prone to develop renal pelvic TCC, which is often diagnosed between the ages of 60 and 70. Wilms tumours are the most common paediatric renal masses, accounting for more than 85% of cases and 7% of all juvenile malignancies.[5-9] The biggest prevalence occurs between the ages of three and four.

Recognizing malignant renal masses and differentiating them from benign counterparts is essential, particularly for small tumours. Although there have been notable advancements, chemotherapy and radiation therapy tend to be ineffective for most cases of renal adenocarcinoma.

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Surgical intervention is still the sole method for achieving long-term survival or a cure for early-stage lesions.

While conventional axial renal CT is generally reliable, various issues can emerge. Changes in patient breathing may lead to motion artefacts or gaps in scanning. The quality of images produced by conventional CT is significantly diminished, hindering the visibility of the kidneys and any masses present within them. If a small tumour (less than twice the image collimation) is not properly centred in the image, it may exhibit partial volumization with surrounding renal parenchyma or even with perinephric fat, resulting in misleading attenuation measurements. Evaluating subtle features within cystic tumours, such as slight wall thickening, fine septations, or tiny nodules, can be challenging due to partial volume. Additionally, a standard scanning procedure can take a considerable amount of time, with typical scan durations around 2 seconds and inter-scan intervals between 3.5 to 9 seconds. Under optimal conditions, a complete scan of the kidneys can exceed one minute. Consequently, it becomes impossible to conduct selective imaging solely during the initial (cortical) phase of renal enhancement when renal cortical enhancement is at its peak. In contrast, Helical CT offers numerous advantages over conventional axial CT. The ability to scan rapidly and continuously allows for the entire sequence to be captured in a single breath hold. Scanning a kidney at a standard pitch of 1:1 (i.e., the relative speed of the table top to image collimation) can be accomplished in approximately 30 seconds with a small 5 mm image collimation.

Holding your breath during scanning reduces the chances of misregistration, which helps to protect more renal tissue. Another significant benefit of Helical-CT is the ability to adjust the level of reconstruction after the scan is completed. While collimation and pitch need to be set during the acquisition, the raw data can be restored at any desired level. Consequently, the technician can reconstruct an axial image at this level, which encompasses the centre of the kidney mass. This positioning enhances the imager's ability to define lesions by optimizing the precision of focal readings and reducing partial-volume effects. The fast scanning time of Helical-CT also facilitates renal imaging across all three phases of renal enhancement with contrast (cortico-medullary, nephrographic, and excretory).

Objectives

1. To identify CT characteristics of renal lesions on Multislice Computed Tomography Urogram (CTU) with intravenous contrast administration in various clinical presentations (Sample size =50 patients) in different age groups (4 yr.-79 yr.).
2. To identify the extent, mass effects, vascularity, and components of focal renal- lesions & to detect any local or distant organ involvement after intravenous contrast administration on multislice CTU.
3. To compare HU values in renal lesions before & after administration of I.V. contrast.
4. Based on CTU features categorize the renal lesions as benign /malignant and correlate with HPE/ surgical results.

MATERIALS AND METHODS

Study Design: A prospective hospital-based observational study.

Study area: Department of Radio Diagnosis, KARUNA Medical College & Hospital, Chitoor, PALAKKAD.

Study Period: 1 year.

Study population: Data for the study, has been collected among patients who visited the department of Radio diagnosis attached to KARUNA Medical College & Hospital, Chitoor, PALAKKAD with suspicious renal lesions.

Sample size: The study consisted of 50 subjects.

Sampling method: Simple random technique.

Inclusion criteria:

- Patients with lesions that are clinically suspected
- Patients who had renal lesions detected by ultrasound.
- Patients with h/o previously resected renal lesion in one kidney & presentation in another kidney.

Exclusion Criteria:

- • Patients who are non-cooperative & morbidly sick.
- • Patient has a previous history of contrast reactions.
- • Simple cysts & extra-renal lesions that have invaded the renal cortex are excluded

Ethical consideration: Institutional Ethical committee permission was taken before the commencement of the study.

Study tools and Data collection procedure: A hospital-based prospective study was conducted among 50 patients (Ages: 4yr-79yr) with clinically diagnosed renal lesions & patients who were identified with renal lesions on ultrasonography & were forwarded for further evaluation. Fever, abdominal pain, hematuria & weight loss were their presenting symptoms. Patients were assessed with Multislice Multidetector CT (Siemens SOMATOM e-motion). After the CT examination, a probable diagnosis was given & these results were compared with HPE/ surgical results as applicable.

Protocol for CT Urogram (CTU)

Patient Preparation: To prevent complications with the administration of the contrast medium, patients were maintained fasting for a minimum of 4 hours before the CT scan. The patient was informed of the risks associated with administering contrast, & permission was obtained before performing the contrast scan.

CT Technique: Initially, an AP topogram abdomen was obtained in each patient with breath held & in the supine position. 5 mm thickness axial sections were obtained from lung bases to ischial tuberosities. An

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unenhanced scan was always followed by an intravenous contrast injection while inspiration was suspended. From upper to lower pole of both kidneys, sections were obtained in the Cortico-medullary(40-60s), Nephrographic-(80-120s), & Excretory(180s) phases. Where necessary, sagittal & coronal reconstructions were produced. At 2.5 mm slice thickness, reconstructions were done. More recent Multi-slice CT techniques, such as curved planar resizing, volume rendering, and Maximum & Minimum Intensity Projections, were done where required. Images were viewed in a direct display console using a variety of window settings, including the abdominal window at 320/40, the lung window at 1400/-600, & the bone window at 2400/200. The size, location, presence of the mass/ calcification/fat or any involvement of adjacent structures with pre & postcontrast attenuation values were all considered when evaluating the pathological lesions.

Statistical analysis: In the present study, descriptive statistical analysis was done. Results for categorical measurements are reported in Number (%) whereas results for continuous measurements are reported as Mean ±SD(Min-Max). At a 5% level of significance, significance is evaluated. Diagnostic statistics including sensitivity, specificity, PPV, NPV, & accuracy have been used to determine the correlation between CT scan & final diagnosis. The chi-square test, Anova test & Fisher Exact test have been used to determine the significance of the relation between CT results & final diagnosis.

RESULTS

Table 1: Distribution of renal lesions among various age groups.

Age Group	Frequency of renal-lesions	Percentage (%)
<15 yrs.	1	2
30-39 yrs.	3	6
40-49 yrs.	8	16
50-59 yrs.	10	20
60- 69 yrs.	19	38
>70 yrs.	9	18
Total	50	100.0

In the present study, patients with ages ranging from 60 to 69 years old represented the highest percentage (38%).

Table 2: Distribution of renal lesions among gender

Gender (M/F)	Number of individuals	Percentage (%)
Male	28	56
Female	22	44
Total	50	100.0

In this specific study, there was a significantly higher proportion of males (56%) as opposed to females (44%).

Table 3: Distribution of renal lesions related to age in years

Lesion	Age(yrs.)						Total	
	<15 yrs.	30-39 yrs.	40-49 yrs.	50-59 yrs.	60- 69 yrs.	>70 yrs.	No.	%
Complex Cyst	0	0	0	2	3	4	9	18
				22.2%	33.3%	44.4%		
Abscess	0	3	4	2	1	0	10	20
		30.0%	40.0%	20.0%	10.0%			
Oncocytoma	0	0	1	1	1	1	04	08
			25.0%	25.0%	25.0%	25.0%		
Angiomyolipoma	0	0	2	2	5	3	10	24
			10.0%	20.0%	60.0%	10.0%		
RCC			2	2	5	3	12	
			16.7%	16.7%	41.6%	25.0%		
Renal Pelvic TCC	0	0	0	0	3	1	04	08
					75.0%	25.0%		
Wilms Tumor	1	0	0	0	0	0	01	02
	100%							
							50	100%

- There were a total of 50 cases, with 33 cases (or 66%) being diagnosed as benign & 17 cases being diagnosed as malignant. RCC is the most common type of malignant renal lesion, accounting for 71% of all malignant renal lesions & accounting for 24% of all renal masses.
- The youngest patient diagnosed with RCC was a 44-year-old male patient, & the oldest patient was a 79-year-old male patient. 05 out of 12 patients (42%) with RCC are between the ages of 60 & 69. The average age was 63.2 years old.
- 1 case of Wilms tumour of patients with were <15 years (100%).

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- The youngest patient diagnosed with Angiomyolipomas (AML) was a 45-year-old female patient, & the oldest patient diagnosed with AML was a 73-year-old female patient. 06 out of 10 patients (60%) with AML are between the ages of 60 & 69. The average age was 61.7 years.

In this study:

- Totally 28 (56%) males & 22 (44%) females, the M: F ratio was 1.3:1.
- Male preponderance (75.0%) in the case of RCC when compared to females (25.0%), male: female ratio is 3:1.
- 8 out of 10 cases of Angiomyolipomas (80.0%) were in females.
- 6 out of 9 cases of Complex cysts (66.7%) are males.

Table 4: Distribution of symptoms related to renal lesions

Malignant Lesions						
Renal Lesion (No.)	**Pain**	**Mass**	**Distension**	**Hematuria**	**Fever**	**Weightloss**
RCC (12)	04	03	0	10	01	07
	33.3%	25.0%	0.0%	83.3%	8.3%	58.3%
RENAL PELVIC TCC (04)	03	02	00	04	00	02
	75.0%	50.0%	0.0%	100.0%	0.0%	50.0%
WILMS TUMOR (01)	00	01	00	01	00	01
	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%
TOTAL	07	06	00	15	01	10
BENIGN LESIONS						
COMPLEX CYST (09)	07	00	00	00	01	01
	77.8%	0.0%	0.0%	0.0%	11.1%	11.1%
ABSCESS (10)	10	00	00	03	09	00
	100.0%	0.0%	0.0%	30.0%	90.0%	0.0%
ONCOCYTOMA (04)	02	00	00	00	00	00
	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ANGIOMYOLIPOMA (10)	08	03	00	00	01	00
	80.0%	30.0%	0.0%	0.0%	10.0%	0.0%
Total	27	03	00	03	11	01

- Haematuria, abdominal pain, & fever are most-common presenting symptoms.
- RCC was found to be the most common type of malignant renal lesion.
- Haematuria present in 83.3%, abdominal pain in 33.3%and weight loss in 58.3% of cases.

Table 5: Renal lesion characteristics on CT

Renal Lesions (No.)	**Calcification**	**Hydrone-phrosis**	**Necrosis**	**Ureter**	**Renal Vein**	**IVC**	**Adrenal**	**LN**	**Liver**	**Lungs**	**Long Bones**
RCC (12)	06	02	07	02	04	02	03	08	02	06	02
	50.0%	16.7%	58.3%	16.7%	33.3%	16.7%	25.0%	66.7%	16.7%	50.0%	16.7%
Renal Pelvic TCC (04)	02	03	02	03	00	00	02	04	03	01	01
	50.0%	75.0%	50.0%	75.0%	-	-	50.0%	100%	75%	25.0%	25%
Wilms Tumor (01)	00	01	01	00	01	00	01	01	01	01	00
	-	100.0%	100.0%	-	100%	-	100%	100%	100%	100%	-
Complex Cyst (09)	08	00	00	00	00	00	00	00	00	00	00
	88.9%	-	-	-	-	--	-	-	-	-	-
Abscess (10)	00	00	00	00	00	00	00	05	00	00	00
	-	-	--	-	-	--	-	50%	-	--	-
Oncocytoma (04)	01	00	00	00	00	00	00	00	00	00	00
	25.0%	-	-	-	-	-	--	-	-	-	-
Angiomyolip-oma (10)	00	00	00	00	00	00	00	00	00	00	00

- The common calcified renal lesion in the present study is a Complex cyst.
- Calcification present in 08 / 09 cases of Complex cyst (35%)
- TCC originating from renal pelvis & proximal ureter, showed an associated hydronephrosis (75%).
- In comparison to benign, malignant renal lesions contained a significantly higher proportion of necrosis (100% Wilms tumour & 58% in RCC).
- Renal vein involvement was observed among malignant renal lesions as much as 33.3% in RCC & 1 case (100%) Wilms tumour; however, this finding was not observed in any of the benign renal lesions.
- 3 out of 12 (16.7%) RCCs had IVC thrombosis.
- Lymph nodes (66.7%) & the lungs (50%) where the primary locations were RCC metastasized.
- The lymph nodes, lungs, liver, & adrenals were all affected by the metastasis of Wilms tumour.
- Renal vein; adrenals; lungs & appendicular skeleton involvement lacking among benign lesions.
- Renal masses mostly presented in the right kidney (62%).
- 09(75%) /12 cases, RCC presented in the right kidney.
- 1 case (100%) Wilms tumour presented in right kidney.
- 06 (67%) /9 cases, complex cyst presented in right kidney.

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- 03 (75%) /4 cases, Oncocytoma presented in the right kidney.
- Renal TCC is equally distributed in bilateral kidneys.
- The lower pole of the right kidney is the most common location for RCC.

Table 6: Comparison between HU values among renal-lesions on a Multislice CTU during pre & post contrast

		No.	Mean HU	Std. Deviation	Minimum	Maximum	'F' value	'p' value
Unenhanced	Benign	33	15.71	10.388	8	29	14.696	<0.001
	Malignant	17	29.00	4.761	20	39		
Corticomedullary	Benign	33	24.29	16.750	10	60	21.190	<0.001
	Malignant	17	57.02	13.296	30	86		
Nephrographic	Benign	33	32.57	25.079	10	85	16.348	<0.001
	Malignant	17	74.70	22.513	38	102		

		No.	Mean HU	Std. Deviation	Minimum	Maximum	'F' value	'p' value
Difference (Corticomedullary -Unenhanced)	Benign	33	8.5714	6.92577	2.00	22.00	10.766	<0.001
	Malignant	17	29.0233	12.52519	4.00	55.00		
Difference (Nephrographic-Unenhanced)	Benign	33	16.8571	15.02696	2.00	46.00	10.312	<0.001
	Malignant	17	46.6977	21.78852	9.00	72.00		
Difference (Corticomedullary -Nephrographic)	Benign	33	8.2857	8.38182	0.00	24.00	4.774	.011
	Malignant	17	18.6744	13.28752	-8.00	38.00		

- On pre contrast scans, benign lesions in present study showed to have HU value: 15.71, while malignant lesions had a higher HU value: 29.
- Mean HU value of benign lesions in CMP is 24.29 & for malignant lesions is 57.02.
- In NP, benign lesions had a mean value of HU: 32.57, whereas for malignant lesions mean value of HU :74.70
- In CMP, benign lesions had mean increased value of HU: 8.5, while malignant renal-lesions had significant rise of 29.02.
- In NP, benign lesions had mean increase in value of HU: 16.8 while malignant lesions had risen in value of HU :46.69.

Table 7: HU values of various renal-lesions during pre & post contrast

Diagnosis	UE HU	CMP HU	NP HU	CMP - UE HU	NP – UE HU	CMP – NP HU	Total No. of patients
COMPLEX CYST	16.5	23.5	32.5	07	09	02	10
ABSCESS	25.33	33	43.66	7.67	18.32	10.66	10
ONCOCYTOMA	28	59	84	32	55	24	04
ANGIOMYOLIPOMA	08	10	10	02	02	0	10
RENAL CELL CARCINOMA	28.96	63.87	83.71	31.8	54.74	22.87	12
RENAL PELVIC TCC	11	15	17.5	04	6.5	2.5	04
WILMS TUMOR	25	48	54	23	28	06	01

Table 8: Sensitivity & Specificity of Multislice CTU for renal-lesions

DIAGNOSIS	True Positive	False Positive	False Negative	True negative	Total
COMPLEX CYST	7	2	0	41	50
ABSCESS	10	0	0	40	50
ONCOCYTOMA	3	1	0	46	50
ANGIOMYOLIPOMA	10	0	0	40	50
RENAL CELL CARCINOMA	12	0	0	38	50
RENAL PELVIC TCC	4	0	0	46	50
WILMS TUMOR	1	0	0	49	50

Diagnosis	Sensitivity	Specificity	PPV	NPV	Accuracy	P value
COMPLEX CYST	100.0	97. 6	88.8	100.0	98	<0.001**
ABSCESS	100.0	100.0	100.0	100.0	100.0	<0.001**
ONCOCYTOMA	100.0	97.8	75.0	100.0	98	<0.001**
ANGIOMYOLIPOMA	100.0	100.0	100.0	100.0	100.0	<0.001**
RCC	100.0	100.0	100.0	100.0	100.0	<0.001**
RENAL PELVIC TCC	100.0	100.0	100.0	100.0	100.0	<0.001**
WILMS TUMOR	100.0	100.0	100.0	100.0	100.0	<0.001**

Final Diagnosis	Radiological diagnosis		Total
	Malignant	Benign	
Malignant	17(TP)	00(FN)	17
Benign	02(FP)	31(TN)	33

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Total	19	31	50

- Sensitivity:100 %
- Specificity: 94 %
- PPV: 90 %
- NPV:100 %
- Accuracy: 96 %

Table 9: Comparison with Zagoria et al.14 study

	Present study		Zagoria et al.	
	Malignant	**Benign**	**Malignant**	**Benign**
UEHU	29±4.7	15.7±10.3	NE	NE
CMPHU	57.02±13.2	24.29±16.7	104±46	19±8
NPHU	74.7±22.5	32.5±25.1	90 ±37	20±8
NP–CMPHU	29.02	8.5	22	01
SENSITIVITY (%)	100		95.2	
SPECIFICITY (%)	94		100	
PPV (%)	90		100	
NPV (%)	100		95.8	
ACCURACY (%)	96		97.72	

Table 10: Comparison with the study done by Kopka et al,[16] analysis of the various Helical-CT phases in showing histologically proven neoplasms

	Present study	**Kopka et al.**
SENSITIVITY (%)	100	100
SPECIFICITY (%)	94	95
PPV (%)	90	96
NPV (%)	100	100
ACCURACY (%)	96	96

Table 11: Comparison with the Garant et al,[17] study regarding the enhancement features of RCC

	Present study	**Garant et al.**
	Solid RCC	**Solid RCC**
UEHU	29±4.7	NE
CMPHU	60.84±11.9	115±36
NPHU	83.59±17.15	76 ±20
NP–CMPHU	28.02	39
SENSITIVITY (%)	100	100
SPECIFICITY (%)	94	88

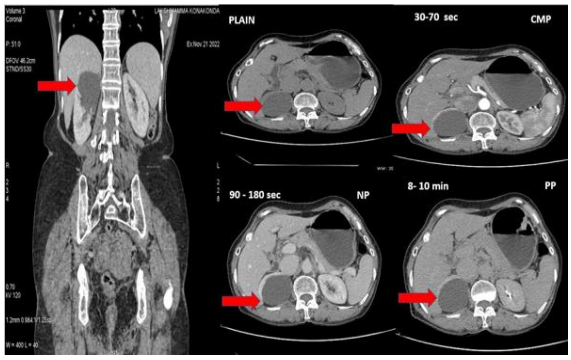

Figure 1: Bosniak type II cyst

Coronal reformatted and axial CT Urogram images showing well defined cystic lesion with hairline thin enhancing septa in upper pole of right kidney.

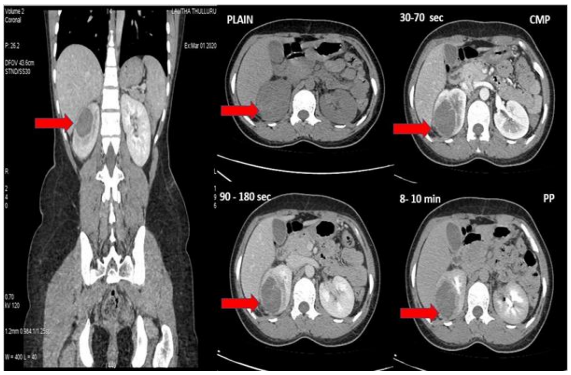

Figure 2: Renal Abscess

Corona! reformatted and axial CT Urogram images showing a well-defined hypodense lesion with thick enhancing septa, few non-enhancing necrotic areas and perilesional oedema in upper pole of right kidney.

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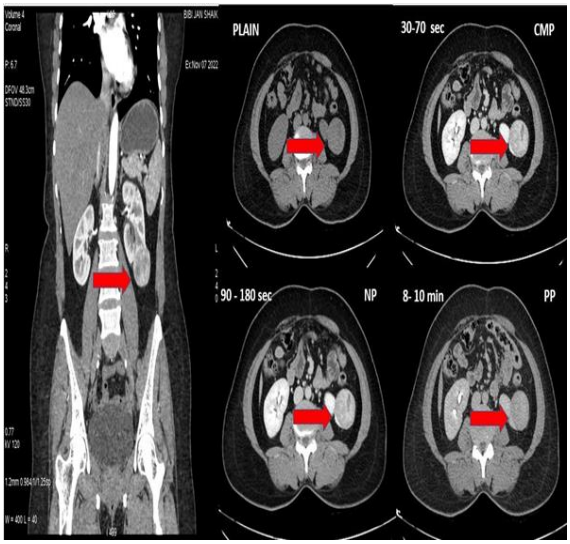

Figure 3: Oncocytoma

Corona! reformatted and axial CT Urogram images showing a well-defined hypodense lesion with thick enhancing septa, few non-enhancing necrotic areas and perilesional oedema in upper pole of right kidney.

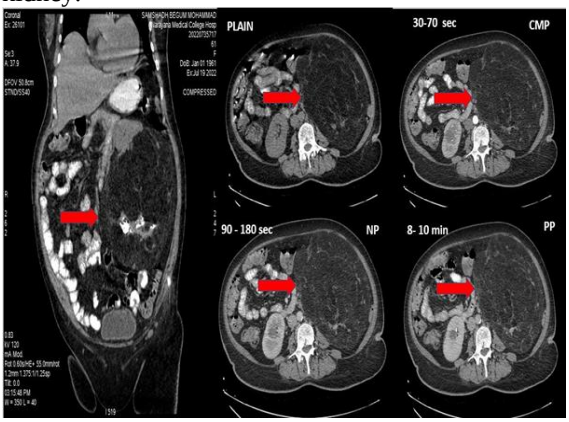

Figure 4: Angiomyolipoma

Corona] reformatted and axial CT Urogram images showing a large well-defined heterogeneously hypodense lesion with few calcifications and irregular iso-dense component within arising from left kidney causing compression and displacement of adjacent bowel loops.

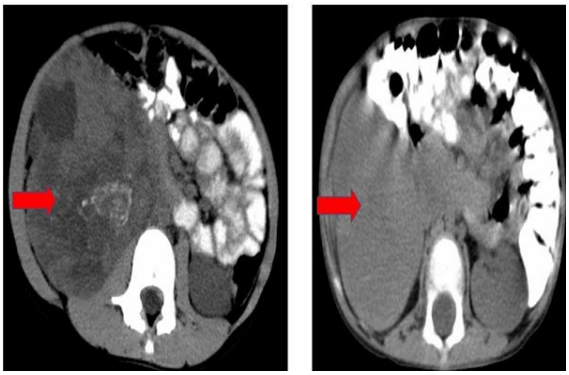

Figure 5: Wilms tumor

Axial CT Urogram images showing a large heterogeneously enhancing hypodense lesion replacing entire right kidney with discrete areas of calcification.

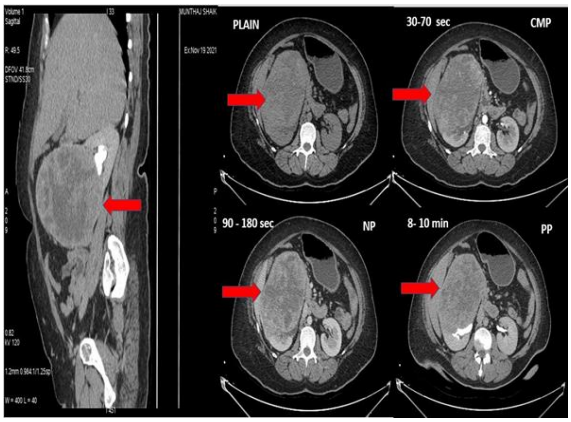

Figure 6: RCC

Sagittal reformatted and axial images showing a large well defined heterogeneously enhancing hyperdense lesion with multiple non-enhancing necrotic areas arising from lower pole of right kidney with mild hydronephrosis and causing mild compression with displacement of IVC.

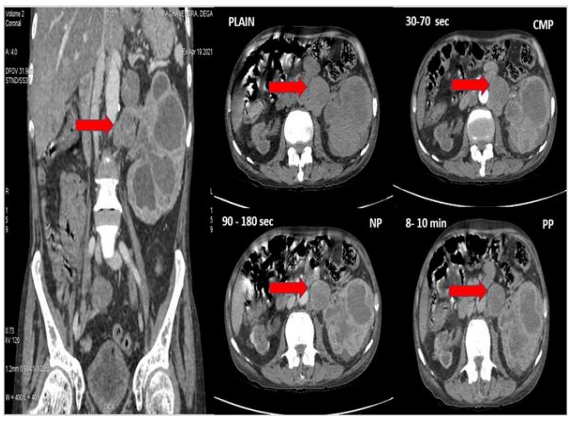

Figure 7: RENAL PELVIC TCC

Coronal reformatted and axial images showing irregular nodular heterogeneously enhancing hyperdense lesion in left renal pelvis extending into proximal ureter with gross hydronephrosis and thinning of renal parenchyma.

DISCUSSION

This prospective study was conducted in teaching hospitals associated with the Department of Radiodiagnosis at KARUNA Medical College & Hospital, Chitoor, PALAKKAD, involving a sample of 50 patients who were clinically diagnosed with renal lesions or had renal lesions identified on ultrasound and were subsequently referred for CT for further characterization. This study aimed to identify the radiological features of renal lesions using a multislice CT Urogram (CTU) and to correlate these findings with the final diagnosis. Patients underwent evaluation using a multislice multidetector CT (Siemens -somatom emotion) with the CT Urogram technique. Following the CT examination, a preliminary diagnosis was established, and these

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findings were compared with histopathological examination (HPE) or surgical results as relevant.

In the present study, out of a total of 50 cases studied, 33 (66%) benign & 17 (34%) malignant renal lesions were diagnosed. The ages of the patients ranged between 4 to 79 years, & a total of 28 males, and 22 females were identified in the present study. RCC (n = 12) accounted for 24% of renal lesions & 71% of malignant lesions. Other malignant lesions are TCC (n = 04) & Wilms tumour (n = 01). Benign lesions were complex cysts (n = 09), angiomyolipoma (n = 10), abscess (n = 10) & oncocytoma (n = 04).

Smith et al,[10] successfully imaged 17 patients ranging in age from 38 to 78 years old who were suspected to have renal lesions. There were 10 male patients & 7 female patients. Patients who had renal lesions further underwent surgeries, renal biopsies, or follow-up examinations. There was a total of 10 cases of RCC, 1 case of TCC, 1 case of angiomyolipoma, 2 cases of complicated renal cysts, & 1 case of pyelonephritis.

There was a total of 70 patients, ranging in age from 4 to 84 years old, who participated in the research that was conducted by Bajwa et al.[11] In 39 (55.7%) of the cases, neoplastic lesions were found, & in 23 (32.9%) of the cases, inflammatory lesions were found. The remainder 8 patients were diagnosed with renal injury in two, urinoma in three, & complicated cysts in three. It was determined that 32 patients had RCC, 3 patients had Wilms tumour, 2 patients had TCC, & 1 patient each had lymphoma & angiomyolipoma. Focal pyelonephritis was found in 12 of the patients, emphysematous pyelonephritis & renal abscess was found in 5 patients each, & Xanthogranulomatous pyelonephritis was found in one patient.

The results of the present study are consistent with the results of Gudbjarston et al,[12] who described the incidence & distribution of renal-cell cancer in a large population & found that the incidence of RCC peaks in the 6^{th} to 8^{th} decade of life with a male to female ratio of 1.3:1. The results of this study & the results of Gudbjarston et al are consistent with one another.[12]

According to Norman Breslow et al,[13] there is substantial evidence that there is female dominance among multicentric & bilateral Wilms tumour cases (P = 0.01). There is evidence to indicate that the female percentage of unicentric cases is lower than that of multi-centric & bilateral cases. This is although the female percentage of unicentric cases is still greater than 50 per cent of total cases (P = 0.06). This corresponds well with the results of the present study, which showed a slight leaning toward female preponderance in cases of Wilms tumour.

Regarding the imaging characteristics of renal masses

- The complex cyst was the most common calcified renal-mass that we found in this study.
- Calcification was observed in 6 out of 12 cases of RCC, which is a 50% prevalence rate.
- There was a 75% association between renal transitional carcinoma & hydronephrosis when the lesion was situated in the renal pelvis & the ureter
- When compared to benign renal lesions, malignant renal- lesions showed a greater amount of necrosis (58% in RCC & 100% in Wilms tumor).
- In 33.3% of cases of RCC, an invasion of the renal vein was observed. & in one case of Wilms tumour, both masses were cancerous, but no benign renal lesion showed any sign of renal vein invasion. This was the only instance of Wilms tumour.
- IVC thrombosis was present in 2 out of 12 (16.7%) cases of RCC.
- The lymph nodes (66.7% of cases) & the lungs (50%) were the organs that were affected by RCC metastases the most frequently.
- he lymph nodes, lungs, liver, & adrenals were all affected by the metastases that originated from the Wilms tumor.
- Distant other involvement such as a renal vein, adrenals, lungs & appendicular skeleton was not seen in benign lesions.

The CT features of 78 RCCs that had been confirmed by pathology were analyzed by Zagoria et al. There was imaging evidence of extrarenal spread in 87 percent of the 61 RCCs that were larger than 50 millimetres, intratumoral necrosis in 61 percent of them, & differential growth rates within 64 percent of them. Smaller tumours, those measuring 50 millimetres or less, tended to have a "benign" appearance, characterized by sharp, rounded margins (88%), and relatively homogenous density (65%), showing distinguishable borders with the kidney (82%). Complacency about the significance of renal lesions should not be undermined. Although RCCs frequently demonstrated transient significant enhancement after initial bolus contrast medium injection (41%), during the infusion phase 97% of them were hypodense in comparison to the kidney, & this was true regardless of the size of the tumour. There was evidence of calcifications in 31% of the RCCs. Even though 22% of RCCs had a predominant cystic component, none of the tumours fulfilled all of the CT criteria for simple renal cysts.

The CT characteristics of Wilms tumour were evaluated by Lowe & Cohen et al,[15] discovered that 1 case of Wilms tumour was intrarenal. Most of the tumours displayed signs of necrosis. In Wilms tumour, calcification is an extremely rare occurrence. There was no encasement present, either with or without displacement, in the Wilms tumour, lymphadenopathy of the retroperitoneal space or continuous extension of the primary tumour into the retroperitoneal space. The results of the present study showed a necrosis rate of one hundred percent, with the disease spreading to lymph nodes nearby.

The results of this study are remarkably comparable to those obtained by Kopka et al,[16] who investigated the effectiveness of UE, CMP, & NP in detecting & characterizing renal masses. This study misinterpreted two malignant renal lesions as benign

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lesions, whereas Kopka et al,[16] had misdiagnosed four cases as benign. The lesser specificity in this study is primarily because of the smaller number of subjects included in our study, which is 50, compared to that of Kopka et al study (n=173).[16]

In both of these studies, RCC showed an enhancement greater than 20 HU following the administration of I.V contrast. The high volume of contrast that was utilized in the CMP study conducted by Garant et al,[17] is the basis of the elevated attenuation value that was observed. Both these studies have demonstrated a diagnostic sensitivity of one hundred percent when it comes to RCC. On MDCT scans, solid vascular lesions can be detected with a sensitivity of one hundred percent if a maximum value of 20 HU is used as the cutoff point. In present study, all of the RCCs exhibited soft tissue attenuation on the precontract scan, & their HU ranged between 60.84±11.9 & 83.59±17.15, respectively, on CMP & NP phases. Jinzaki et al,[18] have also outlined similar results in their article, in which they demonstrated that RCC, being a very vascular tumor, shows significant enhancement (>20HU) in CMP & NP. The higher attenuation value in CMP of Jinzaki et al,[18] study was because of rapid infusion rate of greater contrast volume (120 ml at 3-5 ml/s), whereas the manual injection method in this study required only 80 ml.

CONCLUSION

With a sensitivity of 100%, a specificity of 94%, & an accuracy of 96%, Multislice CTU was able to distinguish a benign lesion from a malignant one, with the acquired images being analyzed in their plain, cortico-medullary, & nephrographic- phases respectively. A rise of more than 20 HU in contrast was seen in RCCs, which displayed a heterogeneous enhancement. Invasion of the renal vein as well as IVC was highly specific for the presence of malignancy.

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